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CUMBERLAND, county seat of Allegany county, Maryland, on the Potomac, 179 miles by rail from Baltimore. It is on the edge of the great coal-basin of the same name, and iron is also largely worked in the vicinity. Pop. about 19,000.

CUMBERLAND, a river of the U. States which runs through Kentucky and Tennessee into the Ohio, having a course of about 600 miles, navigable for steamboats to Nashville, near 200 miles.

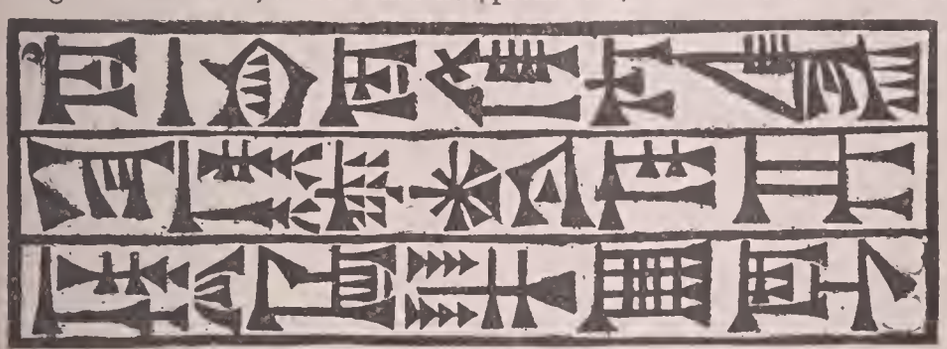
CUMBERLAND MOUNTAINS, in Tennessee, part of a range of the Appalachian system, rarely exceeding 2000 feet in height.

CUMBERLAIND PRESBYTERIANS, so named from the Cumberland country in Tennessee, founded early in the last century, and holding Calvinistic doctrines, except in regard to predestination.

CUMBRIAN MOUNTAINS, a range of hills, England, occupying part of the counties of Cumberland, Westmoreland, and North Lancashire.

CUMMINS, Maria Susanna, an American story writer, born in Massachusetts in 1827, died in 1866. Her principal success was The Lamplighter (1854).

CU'MULATIVE VOTE, the system by which every voter is entitled to as many votes as there are persons to be elected, and may give them all to one candidate, or may distribute them among the candidates, as he thinks fit.



Part of a Babylonian brick, with cuneiform writing.

CUM'YN, COMYN, or **CUMMING,** a family whose name appears frequently in the early history of England and Scotland. It had its original possessions near the town of Comines in France, and from one of the branches sprang the historian Philip de Comines. The English Comyns came over with the Conqueror, and Robert Comyn was sent by William with 700 men to reduce the northern provinces. His nephew became chancellor of Scotland about 1133, and in the middle of the 13th century the family counted among its members four Scottish earls. In the beginning of the 14th century it was almost annihilated by Robert Bruce, who slew the son of its head (the Lord of Badenoch) in Dumfries.

CUNDINAMARCA, one of the departments of the Republic of Colombia. Area, estim. 79,810 square miles; pop. 537,658.

CUNE'IFORM WRITING, the name applied to the wedge-shaped characters of the inscriptions on old Babylonian and Persian monuments; sometimes also described as arrow-headed or nail-headed characters. They appear to have been originally of the nature of hieroglyphs, and to have been invented by the primitive Accadian inhabitants of Chaldea (a Turanian race), from whom they were borrowed with considerable modification by the conquering Babylonians and Assyrians, who were Semites by race and spoke an entirely different language. The use of the character, however, ceased shortly after the reign of Alexander the Great; and after the lapse of nearly two thousand years it was doubted by many if the signs had ever had an intelligible meaning. They were even regarded by some as the work of a species of worm, by others as mere talismanic signs, astrological symbols, and the like. The first hints toward decipherment were given by Karstens Niebuhr late in the 18th century; and the labors of Grotefend, Rask, Burnouf, Lassen, Rawlinson, and other investigators slowly perfected the means of translation. Most of the inscriptions first discovered were in three different languages and as many varieties of cuneiform writing, the most prominent, and at the same time the simplest and latest, being the Persian cuneiform writing with about sixty letters. Next older in time and much more complex is what is designated the Assyrian or Babylonian system of writing, consisting of from 600 to 700 characters, partly alphabetic, partly syllabic, or representing sound groups. Lastly comes the Accadian inscriptions, the oldest of all, originally proceeding from a people who had reached a high state of civilization three thousand years before Christ, and whose language (allied to Turkish) ceased to be a living tongue about 1700 B.C. The most celebrated trilingual inscription is that at Behistun, cut upon the face of a rock 1700 feet high, and recording a portion of the history of Darius. The British Museum contains many thousands of inscribed clay tablets, cylinders, prisms, etc., the decipherment of which is in progress.

CU'PID, the god of love; corresponding with the Greek Erōs. He is represented as a winged infant, naked, armed with a bow, and a quiver full of arrows.

CUPPING, a surgical operation consisting in the application of the cupping-glass in cases where it is desirable to abstract blood from, or draw it to, a particular part. When blood is removed the operation is simply termed cupping; when no blood is abstracted, it is dry-cupping.

CURACAO (kö-rà-sä'ō), an island, Dutch West Indies, Carribbean Sea, 46 miles n. the coast of Venezuela; 36 miles long and 8 miles broad; capital Willemstad, principal harbor Santa Anna. The tamarind, cocoa-palm, banana, and other useful trees are reared—among them three varieties of orange, from one of which the Curaçao liquor is made.

CURACAO, or Curacoa, a liquor or cordial prepared from a peculiar kind of bitter oranges growing in Curaçao, which have a persistent aromatic odor and taste. It is prepared from the yellow part of the rind, which is steeped in strong alcohol, the infusion being afterward distilled and rectified and mixed with syrup. For the true orange, the common bitter orange of Europe is often substituted, and the genuine deep-yellow color imitated by caramel, etc.

CURAS'SOW, or Hocco, the name given to gallinaceous birds natives of the warm parts of America. The crested

Crested curassow.

curassow found in Guiana, Mexico, and Brazil, is a handsome bird, nearly as large as the turkey and more imposing in appearance, being of a dark violet color, with a purplish-green gloss above and on the breast; the abdomen is snow-white, and the crest golden. Another species is the red curassow, also a native of South America, and about the size of a turkey.

CURD. See Cheese and Milk.

CUR'FEW, a practice originated in England by William the Conqueror, who directed that at the ringing of the

bell at eight o'clock all fires and lights should be extinguished. The law was repealed by Henry I. in 1100, but the bell continued to be rung in many dis-

Curfew for fire.

tricts to modern times, and probably may still be heard. The name was also given formerly to a domestic utensil for covering up a fire.

CURICO', a town of Chili, capital of prov. of same name Pop. 9000. Area of prov. 2913 sq. miles; pop. 102,647.

CURIE, Pierre and Madame, discoverers of the metal radium. Professor Curie and Madame Curie were collabo-

M. Curie.

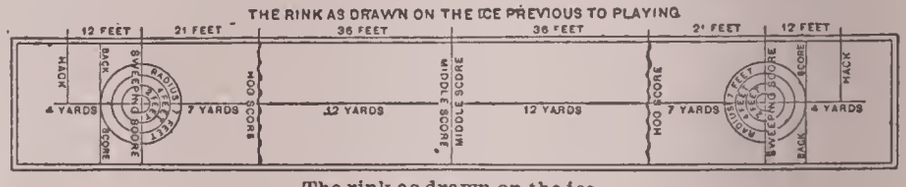
rators in physics at one of the Paris institutes. In 1903 they were awarded the Nobel prize for their discovery. Professor Curie was killed in a street accident at Paris on April 19, 1906, his wife taking his place as lecturer in the Sarbonne.

CURLEW, a genus of birds belonging to the same family as the snipe and woodcock. The genus is characterized by a very long, slender, and arcuated bill, tall and partly naked legs, and a short somewhat rounded tail. The bill is more or less covered with a soft sensitive skin by which the bird is enabled to detect its food in the mud. Three species of curlew are inhabitants of America—the long-billed curlew, about 29 inches long, with a bill 7 to 9 inches in length; the Hudsonian, or short-billed curlew; and the Esquimo curlew

CURLING, a favorite Scottish winter amusement on the ice, in which contending parties slide large smooth stones having somewhat the shape of a flattened hemisphere, weighing from 30 to 45 lbs. each, with an iron or wooden handle at the top, from one mark to another. The space within which the stones move is called the rink, and the hole or mark at each end the tee The length of the rink from tee to tee varies from 30 to 50 yards. The players are arranged in two parties, each headed by a skip or director. The number of play-

Curling stones.

ers upon a rink is eight or sixteen—eight when the players use two stones each, and sixteen when they use one stone each. There may be one or more rinks according to the number of curlers. The object of the player is to lay his stone as near to the mark as possible, to guard that of his partner which has



The rink as drawn on the ice.

been well laid before, or to strike off that of his antagonist. When the stones on both sides have been all played the stone nearest the tee counts one, and if the second, third, fourth, etc., belong to the same side, each counts one more, the number played for being generally twenty-one. If a player's stone does not cross a line, called the hog-score, at some distance in front of the tee his shot goes for nothing and the stone is removed from the rink. The set matches are termed bonspiels.

CUR'RANT, the name of two well-known shrubs, cultivated for their fruit. The red currant, the fruit of which is used principally for tarts and jellies, is a native of S. Europe, Asia, and N. America. The white currant is a cultivated variety of the red, and is used chiefly for dessert and for conversion into wine. The black currant, a native to most parts of Europe, and found abundantly in Russia and Siberia, is used for tarts and puddings and for a fine jelly recommended in cases of sore throat.

CURRANTS, a small kind of dried grape imported from the Levant, chiefly from the vicinity of Patras in the Morea, as also from Zante, Cephalonia, and Ithaca, of which islands they are the staple produce. The plant is delicate and the crop precarious, and as the plantation must be six or seven years old before it bears, its cultivation requires a great outlay of capital After being dried the currants are exported in large butts.

CURRANT WINE, a wine made of the juice of the white or red currant (preferably the former). A pint of water is added to every four pints of berries and afterward a pound and a half of sugar to each pint, a little spirits being mixed in the liquor before it is set aside to ferment. Fermentation requires several weeks, and the wine is not fit for use for some months. For black-currant wine the berries are first put over the fire and heated to the boiling point in as small a quantity of water as possible.

CURRENCY, the medium of exchange used in ordinary business and industry. It is generally in the form of coin or paper, and circulates from hand to hand. The currency of the civilized world is based on gold or silver, and large quantities of safe currency in paper are thus kept afloat. The total currency of the United States is considerably above $2,000,000,000, although all of this is never in circulation. Paper currency consists of the promissory notes of the government or of banks, and certificates for gold and silver coin, good for their face amount in the coin specified at the United States treasury.

CURRENTOM'ETER, Current Gauge, an instrument for measuring the velocity of currents. It may be constructed in various ways, e.g. a simple tube which is bent and has its lower end open to the current, the ascension of water in the vertical part indicating the velocity of the current.

CURRENTS, Marine, masses of seawater flowing or moving forward in the manner of a great stream. They are phenomena of the highest importance, both on account of their influence upon the climate of many maritime regions—an influence often reaching far inland—and their practical relation to the art of navigation. These currents are very numerous, and taken together constitute an oceanic circulation the intricacy and irregularity of whose form is owing to the number and variety of the agencies at work. Among the theories which have been put forward to account for the existence of currents the chief place belongs to the theory of a circuit maintained between equatorial and polar waters. According to this theory there is in either hemisphere an area within which the waters of the ocean are colder, and hence by many degrees denser, than within the belt of the tropics. The natural result is a tendency of the colder and heavier water to sink and to diffuse itself over the lower portion of the ocean-bed, and a movement of the warmer and lighter water in the direction of the surface, over which it tends to become diffused. In other words, the colder waters will move beneath the surface in the direction of the equator, and the warmer waters will flow along the surface in the direction of either pole. Hence, in either half of the globe two great and opposite currents—a cold current flowing from the pole toward the equator, and a

warm current flowing from the equator in the direction of the pole. This theory has been excellently illustrated by Dr. Carpenter's experiment, in which a trough of glass filled with water and having a lump of ice at one end and a heated bar of iron at the other exhibits a similar circulation of hot and cold currents. To this theory Sir C. Wyville Thomson opposed a theory of evaporation as the general cause of the movement, holding that in the Antarctic Ocean at least the return of moisture to the south to balance the cold indraft of water that comes from thence takes place in a large measure through the atmosphere. Another great general cause of currents is to be found in the axial rotation of the earth eastward, by which the movement of tropical waters toward the pole is deflected eastward, and becomes in the northern hemisphere a north-eastwardly current and in the southern a southeastwardly one. Under the operation of the same laws the opposite currents from polar latitudes to the equator are deflected in southwesterly and northwesterly directions respectively. It is to such influences that we may in the main attribute the well-known differences between the climates of North America and Europe within correspondent parallels.

CURRIC'ULUM, originally, in Latin, the course over which the race was run, hence the whole course of study at a university necessary to qualify for a particular degree.

CURRY, an Eastern condiment, a powder composed of cayenne-pepper, coriander, ginger, turmeric, and other strong spices.

CURRYING is the art of dressing cowhides, calves'-skins, seal-skins, etc., principally for shoes, saddlery, or harness, after they have come from the tanner In dressing leather for shoes the leather is first soaked in water until it is thoroughly wet; then the flesh side is shaved to a proper surface with a knife of peculiar construction, rectangular in form with two handles and a double edge. The leather is then thrown into the water again, scoured upon a stone till the white substance called bloom is forced out, then rubbed with a greasy substance and hung up to dry. When thoroughly dry it is grained with a toothed instrument on the flesh side and bruised on the grain or hair side for the purpose of softening the leather. A further process of paring and graining makes it ready for waxing or coloring, in which oil and lamp-black are used on the flesh side. It is then sized, dried, and tallowed. In the process the leather is made smooth, lustrous, supple, and water-proof.

CURTIN, Andrew Gregg, an American politician and governor, known as the "war governor" of Pennsylvania. He was born in Pennsylvania in 1817 and died in 1894. He early allied himself with the republican party and was governor of Pennsylvania during the civil war. He was subsequently a member of congress and minister to Russia.

CURTIS, George Ticknor, an American jurist, born in Massachusetts in 1812, died, 1894. He appeared as counsel in the Dred Scott case, in the legal tender cases, the sewing machine cases, and the Colt revolver suits. He published in its complete form in 1896 his Constitutional History of the United States, and he was the author also of numerous valuable treatises on law, and a Life of Daniel Webster.

CURTIS, George William. an American publicist, editor, and critic, born in Rhode Island in 1824 and died in 1892. He was a member in 1842 of the famous Brook Farm Community, traveled in the Orient, and in 1853 was placed in charge of the Editor's Easy Chair, a department of Harper Bros.' periodicals. In this he continued until his death. He published a number of volumes of essays and critiques and a few novels.

CURVE, a line which may be cut by a straight line in more points than one; a line in which no three consecutive points lie in the same direction. The doctrine of curves and of the figures and solids generated from them constitutes what is called the higher geometry, and forms one of the most interesting and important branches of mathematical science. Curve lines are distinguished into algebraical or geometrical and transcendental or mechanical. The varieties of curves are innumerable; that is, they have different degrees of bending or curvature. The curves most generally referred to, besides the circle, are the ellipse, the parabola, and the hyperbola, to which may be added the cycloid.

CUR'ZON, George Nathaniel, Baron Curzon of Kedleston, an English statesman and author, born at Kedleston in 1859. He served in parliament from 1886 to 1898, in 1891–2 was undersecretary of state for India, and subsequently under-secretary of state for foreign affairs. In 1898 he was appointed viceroy and governor-general of India. He is the author of several important books on the Orient.

CUSCO. See Cuzco.

CUSCO-BARK, the bark of a tree, which comes from Cuzco, in S. America, and is exported from Arequipa. It contains a peculiar alkaloid called cusco-cinchonine, or cusconine, which resembles cinchonine in its physical qualities, but differs from it in its chemical properties. When applied medicinally it excites warmth in the system, and is therefore recommended to be given in cold intermittents and low typhoid states of the system.

CUSH, the eldest son of Ham, and also a country frequently mentioned in the Old Testament, probably in Africa, south of Egypt. In other places it is evident that the name Cush must also be understood as referring to some part of Arabia.

CUSHING, Caleb, an American diplomat and statesman, born in Massachusetts in 1800, died in 1879. In 1844 he was appointed the first American minister to China. He assisted in the work of the treaty of Nankin and established the rights of Christian missionaries in China. Cushing fought in the Mexican war, was attorney-general in Pierce's cabinet, was counsel for the United States in the Alabama claims case and was latterly minister to Spain. He was one of the most talented of American statesmen.

CUSHMAN, Charlotte, an American actress, born at Boston in 1816, died, 1876. She made her first appearance as an opera singer in 1835 but, on the failure of her voice, took up the drama. She became noted for her fine rendition of rôles such as Lady Macbeth, Meg Merrilies, Queen Gertrude, and Ophelia, and for many years was the foremost actress of the American stage.

CUSP, the point at which two converging curves meet and have a common tangent. Such points are numerous in architecture in the internal curvings of trefoils, heads of Gothic windows, etc. In the Decorated and

Architectural Cusps—1, Henry VII.'s chapel. 2, Monument of Sir James Douglas, Douglas church. 3, Beauchamp chapel, Warwick.

perpendicular styles the cusps, in addition to leaves, flowers, etc., were frequently ornamented with heads or animals. In the romanesque and norman styles they were often ornamented with a small cylinder which bore a flower or similar ornament.

CUS'TARD, a composition of milk or cream and eggs, sweetened with sugar and variously flavored. It may be cooked in the oven or stew-pan.

CUSTARD-APPLE, a delicious fruit, a native of the West Indies, but cultivated in most tropical countries. The fruit is large, and heart-shaped, with a thick, rough exterior, and containing a pulp of a sweet flavor, very cooling and agreeable.

CUSTER, George Armstrong, an American soldier, born in Ohio in 1839, and was killed in the summer of 1876 by the Indians of Sitting Bull and Crazy Horse in the Black Hills in

George A. Custer.

Montana. Custer fought during the civil war in the Richmond campaign and was brevetted major-general of the regular army with the actual rank of lieutenant-colonel in 1866. He led Terry's column against the Sioux in the Black Hills in 1876. Coming upon a large encampment on the Little Big Horn River he divided his regiment in

two, ordering one detachment to attack the Indians from the rear while he himself led the attack in front. The force attacking the rear was driven back and then the Indians turned on Custer's detachment and massacred him and his entire force.

CUSTOM, social habit. In law custom has the force of law, and law itself is largely codified custom. General custom constitutes the body of common law, and particular custom binds the inhabitants of special districts, occupations, etc. As an example of the force of general custom is the right of the inhabitants of a country to the use of the sea shore.

CUSTOM-HOUSE, an establishment where commodities are entered for importation or exportation and the duties, bounties, etc., on the same are payable.

CUSTOMS, duties charged upon goods exported from or imported into a country. The revenue derived from this source in the U. States is nearly three hundred million dollars.

CUTCH, a state in the west of India, lying to the south of Sind, under British protection; area, 6500 sq. miles. Pop. 558,415.

CU'TICLE, the epidermis or outermost layer of the skin, a thin, pellucid, insensible membrane that covers and defends the true skin.

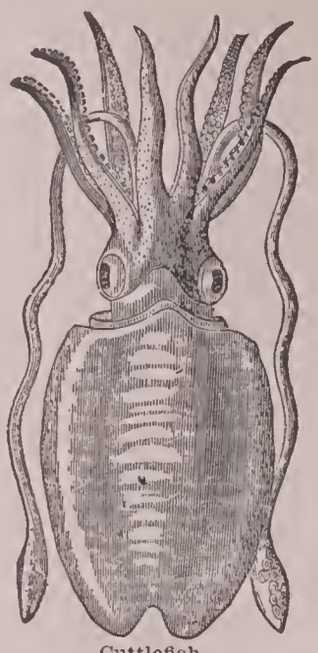
CUT'LASS, a short sword used by seamen. A guard over the hand is an advantage. It is, if well understood, a very effectual weapon in close contact: on account of its shortness it can be handled easily, and yet is long enough to protect a skilful swordsman.

CUT'LERY is a term applied to all cutting instruments made of steel. The finer articles, such as the best scissors, penknives, razors, and lancets are made of cast-steel. Table-knives, plane-irons, and chisels of a very superior kind are made of shear-steel, while common steel is wrought up into ordinary cutlery.

CUTTACK, a town of Hindustan, in Orissa, on the right bank of the Mahanuddy, 60 miles from its embouchure and 230 s.s.w. Calcutta. It has little trade, and is known mainly for its beautiful filagree work in gold and silver. Pop. 51,364.—The district of Cuttack has an area of 3517 sq. miles. It is well watered, and rice, pulse, sugar, spices, dye-stuffs, etc., are grown along the coast, which is low and marshy, and wheat and maize in the hilly regions. On the coast salt is extensively manufactured. Pop. 1,937,671.

CUTTER, a small vessel resembling a sloop, with one mast, and a straight running (not fixed) bowsprit, the sails being usually a fore-and-aft mainsail, gaff topsail, stay foresail, and jib.

CUTTLEFISH, any one of many mollusks, the species of which are numerous and almost world-wide in distribution. They are characterized by the presence of an ink-bag filled with black or brown "sepia," a substance which the animal ejects when pursued, so as to conceal itself from view by coloring the waters around it. Cuttle-bone is in reality the calcareous internal shell of these animals. When powdered it is sold under the name of "pounce," and is used for polishing, for tooth-powder, and in making molds for delicate castings. It was formerly much used in medicine, but is valuable only for its feebly antacid properties. In



Cuttlefish.

the tropical seas cuttlefish have been found weighing 2 tons. They are all marine. Many fossil species occur. Several species are found on the Atlantic coast of the U. States. See Squid.

CUTWORM, any worm or grub which is destructive to cultivated plants, as cabbage, corn, beans, etc.

CUVIER (küv-ya), Georges Léopold Chrétien Frédéric Dagobert, Baron, a distinguished modern naturalist, was born, Aug. 23, 1769, at Montbéliard, then belonging to the duchy of Würtemberg. A natural classification of worms was his first labor. The ability and knowledge shown in this work procured him the friendship of the greatest naturalists of France. He was invited to Paris, established at the Central School there, and received by the Institute as a member of the first class. His lectures on natural history, distinguished not less for the elegance of their style than for profound knowledge and elevated speculation, were attended by all the accomplished society of Paris. In Jan. 1800, he was appointed to the Collège de France. Under Napoleon, who fully recognized his merits, Cuvier held important offices in the department of public instruction. In 1819 he was received among the forty members of the French Academy. He died at Paris, 13th May, 1832.

CUZCO, an ancient city in Peru, capital of a department of the same name, is situated in a wide valley about 11,300 feet above sea-level, between the Apurimac and Urubamba. The houses are built of stone, covered with red tiles, and are many of them of the era of the Incas. The ruins of the fortress built by the Incas, a stupenduous specimen of cyclopean architecture, are still to be seen, as well as other massive specimens of ancient Peruvian architecture. The inhabitants manufacture sugar, soap, cotton, and woolen goods, etc. There is a university, a cathedral, etc. Cuzco is the most ancient of the Peruvian cities, and was at one time the capital of the empire of the Incas. In 1534 it was taken by Pizarro. Pop. 18,730. Area of the department, 95,547 sq. miles; pop. 238,445.

CY'ANIDE, a combination of cyanogen with a metallic base. Cyanide of potassium is used in photography and to separate gold from ores, especially in treating "tailings."

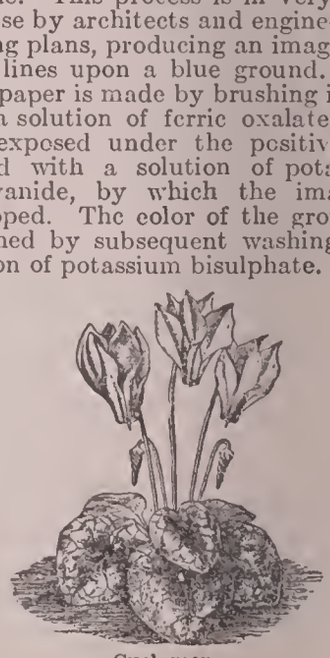
CY'ANIN, the blue coloring matter of certain flowers, as of the violet, cornflower, etc.

CY'ANITE, a mineral of the garnet family found both massive and in regular crystals. Its prevailing color is blue but of varying shades. It is found only in primitive rocks.

CYAN'OGEN, a compound radical composed of one atom of carbon and one of nitrogen. It is a gas of a strong and peculiar odor, resembling that of crushed peach leaves, and burning with a rich purple flame. It is unrespirable and highly poisonous. It unites with oxygen, hydrogen, and most non-metallic elements, and also with the metals, forming cyanides. Combined with hydrogen it forms prussic acid.

CYANOM'ETER, is the name of an instrument invented by Saussure for ascertaining the intensity of color in the sky. It consists of a circular piece of metal or pasteboard, with a band divided by radii into fifty-one portions, each of which is painted with a shade of blue, beginning with the deepest, not distinguishable from black, and decreasing gradually to the lightest, not distinguishable from white. The observer holds this up between himself and the sky, turning it gradually round till he finds the tint of the instrument exactly corresponding to the tint of the sky.

CYAN'OTYPE PROCESS, a photographic picture obtained by the use of a cyanide. This process is in very common use by architects and engineers for copying plans, producing an image with white lines upon a blue ground. Sensitive paper is made by brushing it over with a solution of ferric oxalate; it is then exposed under the positive and treated with a solution of potassium ferricyanide, by which the image is developed. The color of the ground is deepened by subsequent washing with solution of potassium bisulphate.



Cyclamen.

CY'CLAMEN, a genus of bulbous plants, nat. order Primulaceæ or primroses. The species are low-growing

herbaceous plants, with very handsome flowers. Several of them are favorite spring-flowering green-house plants. The fleshy root-stalks, though acrid, are greedily sought after by swine; hence the vulgar name, sowbread.

CYCLE is used for every uniformly-returning succession of the same events. On such successions or cycles of years rests all chronology, particularly the calendar. Our common solar year, determined by the periodical return of the sun to the same point in the ecliptic, everybody knows contains fifty-two weeks and one day, and leap-year a day more. Consequently in different years the same day of the year cannot fall upon the same day of the week. And as every fourth year is a leap-year, it will take twenty-eight years (4x7) before the days return to their former order according to the Julian calendar. Such a period is called a solar cycle. The cycle of the moon, or golden number, or Metonic cycle is a period of nineteen years after which the new and full moons return on the same days of the month.

CYCLING, the art of locomotion by means of a machine consisting of two, three, or sometimes four wheels connected by a light framework of steel and having a seat or seats for one or more riders. It is propelled by the pressure of the rider's feet on two cranks attached to an axle. To the practiced cyclist his cycle is a rapid and easy mode of traveling, and on it he can cover as much as 300 miles in a day. Fully 500 miles have been accomplished by a professional in 24 hours on a prepared track. A remarkable cycling feat was the journey of 12,000 miles by Mr. Thomas Stevens across the continents of America, Europe, and Asia on a bicycle. Commencing in April, 1884, he crossed first America, then Europe, then Asia, finishing at Yokohama in December of the same year. The cycle is now made use of for various practical purposes, in business, military affairs, etc. See Bicycle and Tricycle.

CYCLONE (sī'klōn), a circular or rotatory storm or system of winds, varying from 50 to 500 miles in diameter revolving round a center, which advances at a rate that may be as high as 40 miles an hour, and toward which the winds tend. Cyclones of greatest violence occur within the tropics, and they revolve in opposite directions in the two hemispheres—in the southern with, and in the northern against, the hands of a watch—in consequence of which, and the progression of the center, the strength of the storm in the northern hemisphere is greater on the south of the line of progression and smaller on the north, than it would be if the center were stationary, the case being reversed in the southern hemisphere.

CYCLOPÆDIA. See Encyclopædia.

CYL'INDER, a geometrical solid which, in popular language, may be described as a long round solid body, terminating in two flat circular surfaces which are equal and parallel. There is a distinction between right cylinders and oblique cylinders. In the first case, the axis, that is, the straight line joining the center of the two opposite bases, must be perpendicular, and it may be regarded as described by the revolution of a rectangular parallelogram round one of its longer sides (the axis); in the second, the axis must form an angle with the inferior base.—In steam-engines, the cylinder is the chamber in which the force of the steam is exerted on the piston.

CYLIN'DRICAL LENS, a lens whose surfaces are cylindrical, instead of spherical which is usually the case. A convex cylindrical lens brings the image of a source of light to a focus in a line instead of in a point. They are usually plano-cylindrical, that is, cylindrical on one side and flat on the other.

CYLIN'DRICAL VAULTING, in arch. the most ancient mode of vaulting, called also a wagon, barrel, or tunnel roof. It is a plain half-cylinder without either groins or ribs.

CYM'BALS, musical instruments consisting of two hollow basins of brass, which emit a ringing sound when struck together. They are military instruments, but are now occasionally used in orchestras.

CYNICS (sin'iks), a sect of philosophers among the ancient Greeks, founded by Antisthedes, a scholar of Socrates, at Athens, about 300 B.C. Their philosophy was a one-sided development of the Socratic teaching by Antisthenes and his followers, who looked only to the severer aspect of their master's doctrines, and valued themselves on their contempt of arts, sciences, riches, and all the social civilization of life. They made virtue to consist in entire self-denial and independence of external circumstances. In time this attitude degenerated into a kind of philosophic savagery and neglect of decency, and the cynics fell into contempt.

CY'PRESS, a genus of coniferous trees. The common cypress is a dark-colored evergreen with extremely small leaves, entirely covering the branches. It has

Cypress.

a quadrangular, or, where the top branches diminish in length, pyramidal shape. Cypress-trees, though of a somewhat somber and gloomy appearance, may be used with great effect in shrubberies and gardens. They are much valued also on account of their wood, which is hard, compact, and very durable, of a reddish color and a pleasant smell. The deciduous cypress of the U. States and Mexico, is frequently called the Virginian cypress. Its timber is valuable, and under water is almost imperishable. In parts of the U. States this cypress constitutes forests hundreds of miles in extent.

CY'PRUS, an island lying on the south of Asia Minor, and the most easterly in the Mediterranean. Its greatest length is 145 miles, maximum breadth about 60 miles; area, 3678 sq. miles. The chief features of its surface are two mountain ranges, both stretching east and west, the one running close to the northern shore, and extending through the long north-eastern horn or prolongation of the island, the other and more massive (Mt. Olympus) occupying a great part of the south of the island, and rising in Troödos to 6590 feet. Between them is the bare and mostly uncultivated plain called Messaria. There is a deficiency of water. The climate is in general healthy. The mountains are covered with forests of excellent timber (now under government supervision), and the island is esteemed one of the richest and most fertile in the Levant. Agriculture, however, is in a very backward state, and locusts sometimes cause great damage. Wheat, barley, cotton, tobacco, olives, raisins, and carobs are the most important vegetable products. The wine is famous, especially that known as commandery. Silk-worms are reared, and a coarse kind of silk is woven. Salt in large quantities is produced. The minerals are valuable; the copper-mines were of great importance in ancient times (the name copper is derived from that of this island), and are again being worked. Large numbers of sheep and goats are reared on the extensive pasture lands of the island. The principal towns are Lefkosia or Nicosia, the capital, the only considerable inland town, and the seaports are Larnaca and Limassol. The chief exports are carobs, wine, and cotton, with cheese, raisins, cocoons, wool, etc.

After belonging successively to the Phœnicians, Greeks, Egypt, Persia, and again Egypt, Cyprus in 57 B.C. became a Roman province, and passed as such to the eastern division of the empire. In 1191 it was bestowed by Richard of England (who had conquered it when engaged in the third crusade) on Guy de Lusignan, and after his line was extinct it fell into the hands of the Venetians (1489), with whom it remained till it was conquered by the Turks in 1571 and annexed to the Ottoman Empire. In 1878 it was ceded to Britain by the convention of Constantinople concluded between England and Turkey, its reversion to Turkey being provided if Russia should give up Batoum and Kars The island has become much more prosperous under British administration, and roads, harbor-works, etc., have been constructed, trees planted, and schools opened. The head of the government is the high commissioner, and there is a legislative council of twelve elected and six official members, nine of the former being Greeks, the others Mohammedans. Pop. 237,022, of whom three-fourths belong to the Greek Church.

CY'RUS, King of Persia, a celebrated conqueror. Cyrus conquered his grandfather (B.C. 559), and thus became king of Media and Persia. In 546 he conquered Crœsus of Lydia, and two years later took Babylon. He also subdued Phœnicia and Palestine, and restored the Jews from their Babylonish captivity. He was slain in battle with a Scythian nation in B.C. 529.

CZAR (zär or tsär), a title of the Autocrat of all the Russias, not improbably a corruption of the Roman title Cæsar. It was first adopted in 1579 by Ivan II. The feminine of czar is czarina, meaning the Empress of Russia.

CZAREV'NA, the wife of the czarowitz.

CZAROWITZ or **CZAREVITCH** (zä'rovits, zä're-vich), the title of the eldest son of the Czar of Russia.

CZECHS (che*h*s), the most westerly branch of the great Slavonic family of races. The Czechs have their headquarters in Bohemia, where they arrived in the 5th century. The original of the name is unknown. The total number of the Czechs (including Moravians, Slovaks, etc.) is about 7,500,000, nearly all of whom live in the Austrian Empire. The Czechs proper, in Bohemia, number about 3,200,000. They speak a Slavonic dialect of great antiquity and of high scientific cultivation. The Czech language is distinguished as highly inflectional, with great facility for forming derivatives, frequentatives, inceptives, and diminutives of all kinds. Like the Greek it has a dual number, and its manifold declensions, tenses, and participial formations, with their subtle shades of distinction, give the language a complex grammatical structure. The alphabet consists of forty-two letters, expressing a great variety of sound. In musical value the Czech comes next to Italian.

CZENSTOCHOWA (chen-sto-*h*ō'vâ), a town in Russian Poland, government of Petrokow. There is here a convent containing a famous picture of the Virgin, which is visited by vast numbers of pilgrims. Pop. 65,000.

CZERNOWITZ (cher-nō'vits), a city of Austria, chief town of Bukowina, 138 miles s.e. of Lemberg. It has manufactures of clocks, silver-plate, carriages, toys, etc. Pop. (including suburbs), 54,171, a considerable proportion being Jews.

CZERNY (cher'ni), George, hospodar of Servia, born in the neighborhood of Belgrade about 1770; beheaded by the Turks July, 1817. His true name was George Petrovitch, but he was called Czerny or Kara George, i. e., Black George. In 1801 he organized an insurrection of his countrymen against the Turks, took Belgrade, and forced the Porte to recognize him as hospodar of Servia. In 1813, however, he had to retire before a superior force and took refuge in Austria. Returning to his country in 1817 he was taken and put to death.

CZERNY (cher'ni), Karl, pianist and musical composer, born 1791, died 1857. Among his pupils were Liszt, Thalberg, and other distinguished musicians.

CZOLGOSZ (chol'gotch), Leon, the assassin of President McKinley. He was born at Detroit in 1873 and he was therefore only 28 when he killed McKinley. He was a fanatical anarchist, a dreamer, but was said to be sane. He was executed Oct. 29, 1901. (See McKinley, William.)

D

D, the fourth letter in our alphabet, representing a dental sound formed by placing the tip of the tongue against the foot of the upper teeth, and then forcing up vocalized breath, or voice, into the mouth, the soft palate being raised to prevent its escape through the nose. T is formed in the same way, except that it is uttered with breath merely and not with voice. As a numeral D represents 500.

DAB, a fish belonging to the family of flat-fishes, comprising also the sole, turbot, halibut, plaice, and flounder, the last two being included in the same

Dab.

genus with the dab It is of a pale-brownish color spotted with white on the side which it usually keeps uppermost, and white on the underside, and has rougher scales than the other members of the same genus. It is preferred to the flounder for the table.

DACCA, a commissioner's division of Hindustan in Bengal, at the head of the Bay of Bengal; area, 15,000 sq. miles. It is one of the richest districts in India, and produces such quantities of rice as to be called the granary of Bengal. Pop. 9,844,127, Mohammedans being in a decided majority. Dacca, its capital, is about 150 miles northeast of Calcutta, being free from violent heats, is one of the healthiest and pleasantest stations in Bengal. Pop. 90,542.

DACE, a small river fish of the family Cybrindiæ, and resembling the roach but longer and thinner. It is a gregar-

Dace.

ious fish swimming in shoals and inhabiting chiefly deep clear streams with a gentle current. It seldom exceeds a pound in weight.

DACHSHUND (daks'hunt). See Badger Dog.

DACRYO'MA, a disease of the lachrymal duct of the eye, by which the tears are prevented from passing into the nose and consequently trickle over the cheek.

DAC'TYL, in versification, a foot consisting of one long followed by two short syllables, or, in English, one accented and two unaccented, as happily.

DADDY-LONG-LEGS, a name given to a species of the crane-fly, and to a species of the common house spider.

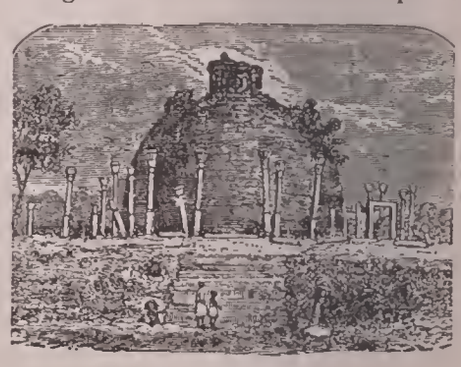
DA'DO, in classical architecture, the middle part of a pedestal, that is to say, the solid rectangular part between the plinth and the cornice; also called the die. In the interior of houses it is applied to a skirting of wood several feet high round the lower part of the walls, or an imitation of this by paper or painting.

DAFF'ODIL, the popular name of a plant which is one of the earliest ornaments of woods and meadows. Many varieties of the daffodil are in cultivation, differing chiefly in bulk and in the form of the flower, which is of a bright primrose-yellow color. There are other forms of the name in local or partial use.

DAGGER, a weapon resembling a short sword, with sharp-pointed blade. In single combat it was wielded in the left hand and used to parry the adversary's blow, and also to despatch him when vanquished.

DAGHESTAN', a province of Russia, in the Caucasus, stretching along the west side of the Caspian Sea; area, 11,036 square miles. Pop. 601,987.

DA'GOBA, in Buddhist countries and those which at one time held the Buddhist faith, a solid structure erected to contain some sacred relic or relics, as distinguished from the term stupa or



Ceylonese dagoba.

tope, which in its specific application is usually restricted to monuments which commemorate some event or mark some spot sacred to the followers of Buddha. Dagobas are built of brick or stone, are circular in form, generally with a dome-shaped top, and are erected on natural or artificial mounds, while the stone or brick structure itself sometimes rises to an immense height. These dagobas have always been held in the highest veneration by the Buddhists, and a common mode of testifying

their veneration is to walk round them, repeating prayers the while.

DAGUERRE (dä-gār), Louis Jacques Mandé, was born in 1789 at Cormeilles, dep. Seine-et-Oise. He was a scene-painter at Paris, and as early as 1814 had his attention directed to the subject of photographic pictures on metal. but it was not till July 5, 1833, that Daguerre succeeded in perfecting the process since called daguerreotype. The new process excited the greatest interest. Daguerre was made an officer of the Legion of Honor, and an annuity of 6000 francs was settled on him. Daguerre died July 10, 1851.

DAGUERREOTYPE PROCESS (da-ger'ro-tīp), the original photographic process, consisting in sensitizing a silver plate with the vapor of iodine, and then placing it in a camera obscura previously focussed, and afterward developing the picture by vapor of mercury. It is then fixed by immersion in hyposulphate of sodium. After thorough washing and drying the picture is covered with glass to prevent its being rubbed off. Daguerreotype has now been superseded by the collodion and other processes.

DAHABIEH (dä-hä-be'e), a boat used on the Nile for conveyance of travelers. It varies considerably in size; has one or

Dahabieh.

two masts with a very long slanting yard on each mast supporting a triangular sail, and accommodates from two to eight passengers.

DAHLGREN, John Adolf, an American naval officer born in Philadelphia in 1809, died in 1870. In 1850 he invented the Dahlgren gun which was found to be very efficient during the civil war. In 1862 he was made chief of the bureau of ordnance, in 1863 became a rear-admiral, commanded the South Atlantic Squadron during the siege of Charleston, silenced Fort Sumter, and performed other valuable services during the war. After the war he was placed in charge of the U. S. Navy Yard in Washington where he remained until his death.

DAHLGREN (däl'gren) **GUNS,** an improved kind of cannon invented by John A. Dählgren, admiral of the United States navy. Their chief peculiarity consists in their having less metal between the muzzle and the trunnions than ordinary cannons.

DAHO'MEY, a French possession in West Africa, formerly a negro kingdom, notorious for the savagery of its inhabitants, and especially for the human sacrifices or "customs" offered up by the king. It lies between the German colony of Togoland on the west and the British territories of Lagos, etc., on the east, and extends inland for about 130 miles with a breadth of about 70.

It is well wooded and watered, and very fertile. The chief export is palm-oil. The king used to keep up an army of 10,000, a number being female warriors. The capital is Abomey, the chief port Whydah. In 1890 the king granted France a protectorate over the coast. A year or two after, hostilities broke out with the French, who defeated the king and have made Dahomey a colonial possession. Pop. 600,000.

DAIRY, the department of a farm which is concerned with the production of milk and its manufacture into butter and cheese. As a rule the soil and climate of a country, and the nearness of suitable markets, determine in a great measure the choice between tillage and dairy husbandry. For milk dairies cows that yield abundantly are selected, while for butter and cheese dairies the rich quality of the milk is the principal point. Regularity in feeding is very important, and the nature of the food given has a great effect on the quality of the milk. The younger the cow is the richer is her milk, and the second and third years, therefore, are generally the most profitable, both quantity and quality being taken into account. In general, after the seventh or eighth year it is not considered advisable to continue the cow longer in milk, as her milk is fast deteriorating and she consumes more food than a young one.

DAIS, a platform or raised floor at the upper end of an ancient dining-hall, where the high table stood; also a seat with a high wainscot back, and sometimes with a canopy, for those who sat at the high table. The word is also sometimes applied to the high table itself.

DAISY, the name of a plant which is very familiar, and a great favorite. It never ceases to flower, is found in all pastures and meadows, and ascends nearly to the summit of the highest mountains. Its name is literally day's eye, being given because it opens and closes its flower with the daylight.

DAKOITY. See Dacoity.

DAKOTA, North. See North Dakota.

DAKOTA, South. See South Dakota.

DAKOTA INDIANS. See Sioux.

DALHOUSIE (dal-hö'zi), James Andrew Brown Ramsay, tenth Earl and first Marquis of, born in 1812; British statesman. After filling the offices of vice-president (1843), and president of the board of trade (1844), he was appointed governor-general of India (1847). In this post he showed high administrative talent, establishing railway lines, telegraphs, irrigation works, etc., on a vast scale. He greatly extended the British empire in India, annexing the Punjab, Oude, Berar, and other native states, as well as Pegu in Burmah. In 1849 he was made a marquis, and obtained the thanks of both houses of parliament. He outstayed his term of office to give the government the aid of his experience in the annexation of Oude; and when he returned to Europe in 1856 it was with a constitution so completely shattered that he was never able to appear

Marquis of Dalhousie.

again in public life, and died on 19th December, 1860. As he left no direct male issue, his marquisate expired with him.

DALLAS, a city of Texas, county seat of Dallas County, on the five principal railroads running through Texas. The city has large grain and manufacturing interests, and is one of the largest distributing centers of agricultural instruments in the United States. It has a Roman Catholic and a Protestant Episcopal Cathedral, a $300,000 court house, a hospital, a handsome confederate monument and many beautiful residences. The population is 90,000.

DALLAS, George Mifflin, an American statesman, born in Philadelphia in 1792, died 1864. He accompanied Gallatin on his mission to St. Petersburg, studied law, was elected to the United States senate in 1831, was made minister to Russia in 1837, vice-president of the United States from 1845 to 1849, and minister to Britain from 1856 to 1861. Dallas's forte lay in his talent as a diplomat.

DALLES (dalz), the name given to various rapids and cataracts in North America. The Great Dalles of the Columbia are about 200 miles from its mouth, where the river is compressed by lofty basaltic rocks into a roaring torrent about 58 yards in width; the Dalles of the St. Louis are a series of cataracts near Duluth, Minnesota.

DALMA'TIA, a province of Austria, with the title of kingdom, the most southern portion of the Austrian dominions. It consists of a long narrow triangular tract of mountainous country and a number of large islands along the northeast coast of the Adriatic Sea, and bounded n. by Croatia, and n.e. by Bosnia and Herzegovina. In breadth it is very limited, not exceeding 40 miles in any part; its whole area is 4940 English square miles. Pop. 527,-426.

DALMATIAN DOG, a variety of dog, called also the Danish, spotted, or coach dog. See Coach-dog.

DALMAT'IC, or **DALMATICA,** an ecclesiastical vestment worn by the deacon at mass, so called because it was an

imitation of Dalmatian costume. It is worn also by bishops under the chasuble. It is a long robe with large full sleeves with black or red longitu-

Dalmatica, cathedral of Chartres (twelfth century).

dinal stripes and partially unclosed sides. A similar robe was worn by kings and emperors at high solemnities, and continues still to be worn by the sovereigns of England on such occasions.

DALTON, John, an English chemist and natural philosopher, born in 1766. After teaching for twelve years at Kendal, in 1793 his reputation as a mathematician won for him the chair of mathematics at the New College, Manchester. Here he continued to reside (though the college was removed in 1799), publishing from year to year valuable essays and papers on scientific subjects, while he also lectured in London, and visited Paris. In 1808 he announced (New System of Chemical Philosophy) his atomic theory of chemical action, the discovery of which spread his fame over Europe. Various academic and other honors were bestowed upon him, and in 1833 he received a pension of $750, afterward increased to $1500. He died July 27, 1844.

DALY, John Augustin, an American theatrical manager, born in North Carolina in 1838, died in 1899. In 1869 he opened the Fifth Avenue Theater in New York in which appeared Fanny Davenport, Mrs. Scott Siddons, E. L. Davenport, Clara Morris and others. In 1879, after a visit to Europe, he opened Daly's Theater on Broadway. He produced many of the best of American plays and was one of the most efficient managers in the development of the American stage.

DAM, a bank or construction of stone, earth, or wood across a stream for the purpose of keeping back the current to give it increased head, for holding back supplies of water, for flooding lands, or for rendering the stream above the dam navigable by increased depth. Its material and construction will depend on its situation and the amount of pressure it has to bear. For streams which are broad and deep strong materials are required, usually stone masonry bound in hydraulic cement and a strong framework of timber. The common forms of a dam are either a straight line crossing the stream transversely, or one or two straight lines traversing it diagonally, or an arc with its convex side toward the current. See Embankment and Reservoir.

DAM, Tinker's, a small bank of clay or dough which a tinker places around his solder until it sets. The phrase is used facetiously, as in the expression, "not to give a tinker's dam," deriving its force from the insignificance of the instrument itself and its worthlessness after it has served its purpose.

DAM'AGES, in law, pecuniary compensation paid to a person for loss or injury sustained by him through the fault of another. It is not necessary that the act should have been a fraudulent one; it is enough that it be illegal, unwarrantable, or malicious. If, however, a person has suffered a loss through fraud or delict on the part of another, that person has not only a claim to ordinary damages, but may also claim remote or consequential damages, and may estimate the amount of the loss he has sustained not at its real value, but at the imaginary value which he himself may put upon it, subject, however, to the modification of a judge or a jury. In other cases the damages cover only the loss sustained estimated at its real value, together with the expenses incurred in obtaining damages.

DAMAN (*da-mān'*), a seaport, Hindustan, at the mouth of the Gulf of Cambay, 100 miles north from Bombay. It belongs to the Portuguese; area, 82 sq. miles; pop. 49,084.

DAMAS'CUS, a celebrated city, capital of the Turkish vilayet of Syria, supposed to be the most ancient city in the world. It is beautifully situated on a plain which is covered with gardens and orchards and watered by the Barrada. The appearance of the city, as it first opens on the view, has been rapturously spoken of by all travelers; but the streets are narrow, crooked, and in parts dilapidated, and, except in the wealthy Moslem quarter, the houses are low, with flat-arched doors and accumulations of filth before the entrance. Within, however, there is often a singular contrast, in courts paved with marble and ornamented with trees and spouting fountains, the rooms adorned with arabesques and filled with splendid furniture. Damascus is an important emporium of trade in European manufactures; it is also a place of considerable manufacturing industry in silk, damasks, cotton and other fabrics, tobacco, glass, soap, etc. Saddles, fine cabinet-work, and elegant jewelry are well made; but the manufacture of the famous Damascus blades no longer exists. It is one of the holy moslem cities, and continues to be the most thoroughly oriental in its features of any city. Of its origin nothing certain is known; but it is mentioned as a place of some note in Gen. xiv. 15. After being held by the Israelites, Assyrians, Persians, Greeks, Romans, and Arabs, it passed in 1516 to the Turks. It now has gas-works and tramways, and railways connect it with Beyrout and the Hauran. Pop. 215,000.

DAMASCUS-STEEL, a kind of steel originally made in Damascus and the East, greatly valued in the making of swords for its hardness of edge and flexibility. It is a laminated metal of pure iron and steel of peculiar quality, carbon being present in excess of ordinary proportions, produced by careful heating, laborious forging, doubling, and twisting.

DAM'ASK, the name given to textile fabrics of various materials, ornamented with raised figures of flowers, landscapes, and other forms, being the richest species of ornamental weaving, tapestry excepted. Damask is very commonly made in linen for table napery.

DAMASKEEN'ING, the ornamenting of iron and steel with designs produced by inlaying or incrusting with another metal, as gold, silver, etc., by etching, and the like.

DAMIENS (*dà-mē-ăn'*), Robert François, notorious for his attempt to assassinate Louis XV., born in 1715 in the village of Tieulloy. On Jan. 5, 1757, as Louis XV. was getting into his carriage to return from Versailles to Trianon, he

was stabbed by Damiens in the right side. The wound was of a trifling nature, and Damiens, who made no attempt to escape, declared he never intended to kill the king. Damiens was condemned and torn in quarters by horses March 28, 1757, on the Place de Grève at Paris.

DAM'OCLES, a native of Syracuse, and one of the courtiers and flatterers of the tyrant Dionysius the elder. One day he was extolling the grandeur and happiness of Dionysius, whereupon the latter invited him to a magnificent banquet, where he would be regaled with regal fare and regal honors. In the midst of the entertainment, however. Damocles happened to look upward, and perceived with dismay a naked sword suspended over his head by a single hair, and was thus taught to form a better estimate of royal honors.

DAMON AND PYTHIAS, two illustrious Syracusans, celebrated as models of constant friendship. Pythias had been unjustly condemned to death by Dionysius the younger, tyrant of Sicily; but, having to leave Syracuse to arrange his affairs, his friend Damon was taken as a pledge that Pythias should return on the day fixed. Pythias, however, being unexpectedly detained, had great difficulty in reaching Syracuse in time to save Damon being executed in his place; and Dionysius was so affected by this proof of their friendship that he pardoned Pythias.

DAMPERS, certain movable parts in the internal frame of a pianoforte, which, whenever the finger leaves the key, descend upon the wires and instantly check the vibration.—Dampers also denote the iron plates used to regulate the draft of flues.

DAMPS, noxious exhalations issuing from the earth, and deleterious or fatal to animal life. Damps exist in wells which continue long covered and not used, and in mines and coal-pits; and sometimes they issue from the old lavas of volcanoes. These damps are distinguished by miners under the names of choke-damp, consisting chiefly of carbonic acid gas, which instantly suffocates; and fire-damp, consisting chiefly of light carburetted hydrogen, so called from its tendency to explode.

DAM'ROSCH, Leopold, a German-American composer and conductor, born in Pasen, Prussia, in 1832, died in 1885. In 1855 he began his musical career as a violinist, and became prominent in Germany as a composer and director. In 1871 he removed to New York as director of the Arion Society. In 1884 he established German opera in New York and in other ways aided musical growth in the U. States.

DAM'ROSCH, Walter Johannes, an American musician, son of Leopold Damrosch, born in Breslau, Prussia, in 1862, and was brought to the U. S. by his parents in 1871. He has been conductor of several important musical organizations and opera performances and in 1896 produced the Scarlet Letter, an opera founded on Hawthorne's novel.

DAM'SON, a variety of the common plum. The fruit is rather small and oval, and its numerous sub-varieties are of different colors: black, bluish, dark purple, yellow, etc. The damson (curruption of Damascene), as its name imports, is from Damascus.

DAN, one of the sons of Jacob by his concubine Bilhah. At the time of the exodus the Danites numbered 62,700 adult males, being then the second tribe in point of numbers. The territory assigned them in Canaan lay on the coast, in the immediate neighborhood of the hardy and well-equipped Philistines, and the Danites were pushed back into a more mountainous region. The tribe also possessed an isolated portion of territory in the extreme north of Canaan, containing the town of Laish or Dan, which gave rise to the proverbial expression "from Dan to Beersheba." The most notable person connected with the tribe was Samson.

DA'NA, Charles Anderson, an American journalist born in New Hampshire in 1819, died in 1897. He was one of the socialists of the Brook Farm experiment and from 1847 to 1862 was connected with the New York Tribune. In 1863–4 he was assistant secretary of war, and after the war became the proprietor of the New York Sun, which he remained until his death.

DANA, James Dwight, a noted American geologist, born in New York in 1813, died in 1895. His principal work was done as a member of the Wilkes Exploring Expedition (U. States government) the results of which were published by the government in 1846, 1849, and 1852. From 1846 he was the editor of the American Journal of Science. Dana was honored by foreign scientific societies perhaps more than any other American. Since 1850 he had been professor of natural science at Yale.

DANA, Richard Henry, an American writer and poet, born in Massachusetts in 1787, died 1879. In 1815 he was made editor of the North American Review, and later worked in conjunction with Bryant in a journalistic venture called the Idle Fellow. His collected works were published in 1850.

DANA, Richard Henry, an American writer, son of Richard Henry Dana, the poet. He was born in Massachusetts in 1815, and died in 1882. He contributed to periodicals and published several works dealing with travel and nautical life. He left no lasting work.

DAN'AE, in Greek mythology, daughter of Acrisius, king of Argos. She was shut up by her father in a brazen tower, but Zeus, inflamed with passion for her, transformed himself into a golden shower, and descended through the apertures of the roof into her embraces. Set adrift on the waves by her father, she reached safely one of the Cyclades, where her child, Perseus, was brought up.

DAN'BURY, a town in Connecticut, about 53 miles n.n.e. of New York. It has notable manufactures of hats, shirts, and sewing-machines. Pop. 18,140.

DANCE OF DEATH. See Death, Dance of.

DANCING, a studied and rhythmical movement of the limbs generally adjusted to the measure of a tune. In ancient times it was generally an expression of religious, patriotic, or military feeling, as in the case of the dance of David before the ark, the choric dances, or the Pyrrhic dance of the Greeks. The Romans, however, like the orientals, had their dancing done by hired slaves. This solemn character of the dance has declined with the progress of refinement and civilization, and it is now nothing more than an elegant social amusement and an agreeable spectacle at public entertainments.

DANCING FAUN, a bronze sculpture found in Pompeii in 1853, which has given the name to the ruined house in which it was discovered.

DANCING GIRLS, the Nautch girls of India.

DANCING MANIA, a form of hysteria in medieval Europe, in which men and women, apparently crazed, danced in the streets of Aix-la-Chapelle, until they fell exhausted. This frenzy was of a religious order and spread over many cities of Europe. The mania seemed to yield to the exorcisms of the priests.

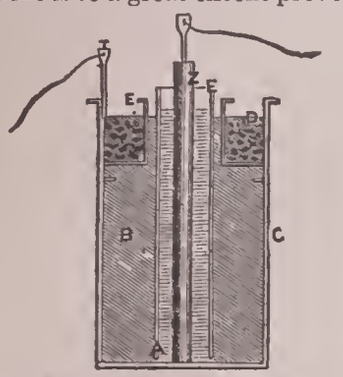
DANDELI'ON, a plant indigenous to Europe, but now also common in America. The leaves are all radical, and runcinate or jagged on the margin. From this circumstance has been derived its French name dent de lion (lion's tooth), of which the English appellation is a corruption. The stems are hollow and have one large bright-yellow flower and a tapering milky perennial root, which acts as an aperient and tonic, and is much esteemed in affections of the liver. The whole plant is full of a milky and bitter juice. The seed of the plant is furnished with a white pappus, and is transported far and wide by the wind.

DANE'GELT, Dane'geld (that is, "Dane tax"), in English history, an annual tax laid on the English nation for maintaining forces to oppose the Danes, or to furnish tribute to procure peace. It was at first one shilling, and ultimately seven, for every hide of land, except such as belonged to the church, When the Danes became masters of England the danegelt was a tax levied by the Danish princes on every hide of land owned by the Anglo-Saxons.

DAN'IEL, the prophet, a contemporary of Ezekiel, was born of a distinguished Hebrew family. In his youth, B.C. 605, he was carried captive to Babylon, and educated in the Babylonish court for the service of King Nebuchadnezzar. Thrown into the lions' den for conscientiously refusing to obey the king he was miraculously preserved, and finally made prime-minister in the court of the Persian king Darius. He ranks with what are called the "greater prophets." The book of the Old Testament which bears his name is divided into a historical and a prophetic part. Modern criticism generally regards it as written during the oppression of the Jews under Antiochus, about 170 B.C. It is partly in Chaldee.

DANIELL'S BATTERY, a galvanic battery the cells of which were originally constructed in the following way. A tall cylindrical copper vessel was nearly filled with saturated solution of sulphate of copper. A rod of amalgamated zinc

was inclosed in a skin or bladder, which was filled with dilute sulphuric acid, and was suspended in the copper cylinder. When the zinc rod is connected by a wire with the copper vessel, which itself forms one of the plates of the battery, the current passes, according to common phraseology, from the copper through the wire to the zinc. Instead of the bladder or skin porous earthenware pots are now employed to contain the dilute sulphuric acid in which the zinc is immersed. In improved modifications of Daniell's battery the most important change is that of substituting for the dilute sulphuric acid that surrounds the zinc, solution of sulphate of zinc, and in this case the zinc is not amalgamated. By doing away with the sulphuric acid local waste of the zinc is to a great extent prevented,



Daniell's Battery.—Section of Cell.

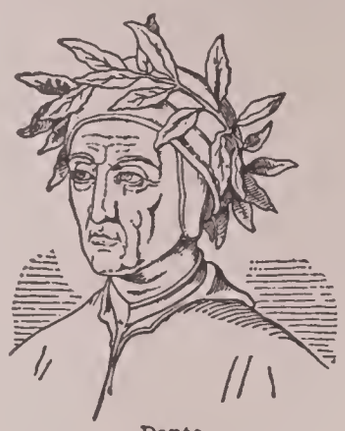
c, Outer copper cell. B, Solution of sulphate of copper. D, Shelf for sulphate of copper. E, Porous cell. A, Sulphuric acid. Z, Zinc.

and the solution of sulphate of zinc is used instead of pure water on account of the very high resistance of water impregnated with salts.

DAN'ITES, the band of assassins and "avengers on the gentiles" which was organized among the Mormons in 1837; also called "the destroying angels." Many crimes were attributed to the Danites, whose existence, by the way, has always been denied by the Mormons themselves.

DAN'NAT, William T., an American painter, born in New York in 1853. He became a resident of Paris, a teacher in the Ecole des Beaux Arts, and has exhibited at numerous European exhibitions. Dannat has lived continuously in Europe since boyhood and is an American only in name.

DANTE ALIGHIERI (dän'tā ä-lē-gē-ä'rē), the greatest of Italian poets, was born in Florence about the end of May, 1265. He seems to have been quite a boy, no more than nine years of age, when he first saw Beatrice Portinari and the love she awakened in him he has described in that record of his early years, the Vita Nuova, as well as in his later great work, the Divina Commedia, in terms which make it hard to distinguish the real personality of Beatrice from some ideal power of beauty and virtue of which she is to Dante the symbol. Their actual lives at least went far enough apart, Beatrice marrying a noble Florentine, Simone Bardi, in 1287, and dying three years afterward; while the year following Dante married Gemma dei Donati, by whom he had seven children. He died Sept., 1321. His great poem, the Divina Commedia (Divine Comedy), is divided into three parts, entitled Hell, Purgatory, and Paradise. The poet dreams that he has wandered into a dusky forest, when the



Dante.

shade of Virgil appears and offers to conduct him through hell and purgatory. Further the pagan poet may not go, but Beatrice herself shall lead him through paradise. The journey through hell is first described, and the imaginative power with which the distorted characters of the guilty and the punishments laid upon them are brought before us; the impressive pathos of these short histories—often compressed in Dante's severe style into a couple of lines—of Pope and Ghibelline, Italian lord and lady; the passionate depth of characterization, the subtle insight and intense faith, make up a whole which for significance and completeness has perhaps no rival in the work of any one man. From hell the poet, still in the company of Virgil, ascends to purgatory, where the scenes are still mostly of the same kind though the punishments are only temporary. In the earthly paradise Dante beholds Beatrice in a scene of surpassing magnificence, ascends with her into the celestial paradise, and after roaming over seven spheres reaches the eighth, where he beholds the "glorious company which surrounds the triumphant Redeemer." In the ninth Dante feels himself in presence of the divine essence, and sees the souls of the blessed on thrones in a circle of infinite magnitude. The Diety himself, in the tenth he cannot see for excess of light.

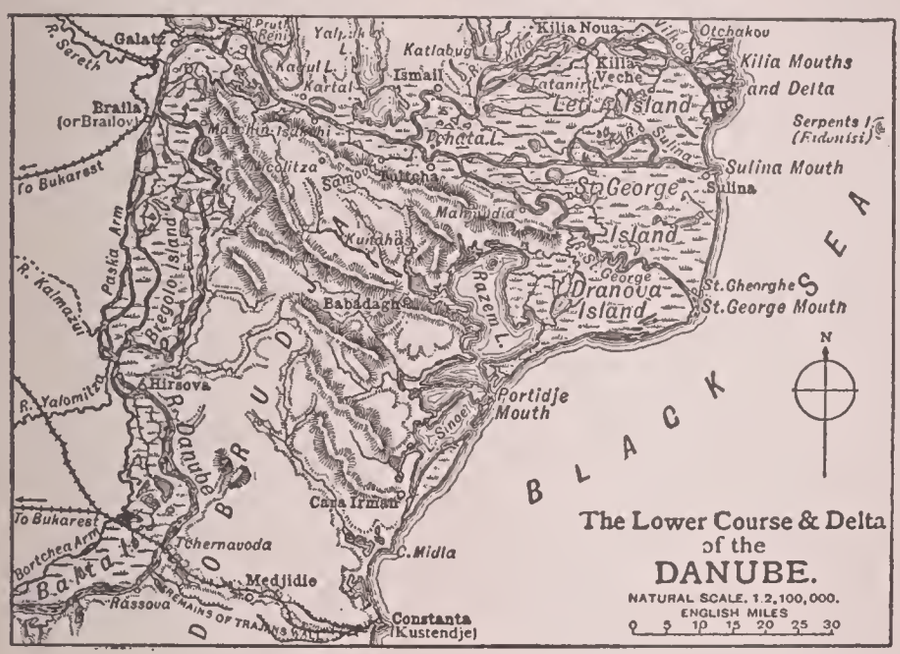
DANTON (dän-tōn), Georges Jacques, an advocate by profession, and one of the great figures in the French Revolution, born 1759. His colossal stature, athletic frame, and powerful voice contributed not a little, together with his intellectual gifts and audacity, to win him a prominent position among the revolutionaries. He founded the club of the Cordeliers, was foremost in organizing and conducting the attack on the Tuileries, Aug. 10, 1792, and as a reward for such services was made minister of justice and a member of the provisional executive council. When the advance of the Prussian army spread consternation among the members of the government Danton alone preserved his courage, and in a celebrated speech summoned all Frenchmen capable of bearing arms to march against the enemy. He voted for the capital punishment of all returning aristocrats, but undertook the defense of religious worship, and along with Robespierre brought Hébert and the worshipers of the goddess Reason to the scaffold. But the rivalry of the two great leaders had now reached a point when one must succumb, and the crafty Robespierre succeeded in having Danton denounced and thrown into prison, 31st March, 1794. Five days afterward he was condemned by the revolutionary tribunal as an accomplice in a conspiracy for the restoration of monarchy, and executed the same day.

DANTZIG, or **DANZIG** (dänt'zih), a fortified town and port, Prussia, capital of the province of West Prussia, 253 miles n.e. Berlin, on the left bank of the west arm of the Vistula, about 3 miles above its mouth in the Baltic, and inter-

sected by the Mottlau, which here divides into several arms. It is one of the most important seaports in the Prussian monarchy. The prosperity of the town is founded chiefly on its transit trade, particularly in wheat from Poland. There is also a considerable trade in amber. Pop. 140,539.

DAN'UBE, a celebrated river of Europe, originates in two small streams rising in the Schwarzwald, or Black Forest, in Baden, and uniting at Donaueschingen. The direct distance from source to mouth of the Danube is about 1000 miles, and its total length, including windings, about 1670 miles. From its source the Danube flows in a northeasterly direction to Ulm, in Würtemberg, where it becomes navigable for vessels of 100 tons; thence to Ratisbon in Bavaria, where it becomes navigable for steamers. Here it turns in a southeasterly direction, entering Austria at Passau, passing Vienna and Budapest, above which latter town it suddenly turns due south, holding this direction till it is joined by the Drave, after which it runs s.s.e. and enters Servia at Belgrade. Continuing its general course eastward it forms for a long distance the boundary line between Roumania and Bulgaria. At Silistria it once more turns northward, and flowing between Roumania and Bessarabia falls into the Black Sea by three different outlets. In the upper part of its course, through Würtemberg and Bavaria, the Danube flows through some of the most fertile and populous districts of its basin. Its principal affluents here are the Iser and Lech. In Austria it passes through a succession of picturesque scenery till past Vienna, the land on both sides being

well peopled and cultivated. The principal affluents are the March, or Morawa, and the Ens. After passing through what is called the Carpathian Gate, at Pressburg, where it enters Hungary, it gives off a number of branches, forming a labyrinth of islands known as Schütten, but on emerging it flows uninterruptedly southward through wide plains interspersed with pools, marshes, and sandy wastes. The principal affluents here are the Save, the Drave, and the Theiss. Sixty miles before entering Roumania the river passes through a succession of rapids or cataracts which it has made in cutting a passage for itself through the cross chain of hills which connect the Carpathian Mountains with the Alps. The last of these cataracts, at Old Orsova, is called the Iron Gate. The lower course of the Danube, in Roumania and Bulgaria, is through a flat and marshy tract, fertile but badly cultivated and thinly peopled. In this part it increases its width from 1400 to 2100 yards, and latterly forms an expanse like a sea, and is studded with islands. Of the three outlets the Sulina Mouth is the deepest, and is usually chosen by ships bound up the river. The Danube is navigable for steamers up to Regensburg (Ratisbon), nearly 1500 miles from its mouth. Some of its tributaries, such as the Save, the Theiss, and the Drave, are also navigable, so that the water system of the Danube may be estimated as admitting of about 2500 miles of steam navigation.



DANUBIAN PRINCIPALITIES. See Roumania.

DAN'VERS, a town including several villages, in Essex Co., Mass., four miles northwest of Salem; on the Boston and Maine Railroad. The manufactures include shoes, leather, morocco, brick, motor vehicles, electric lamps, iron, rubber, soap, etc. Pop. 10,100.

DAN'VILLE, a city and county seat of Vermilion Co., Ill., 125 miles south of Chicago; on the Vermilion River, and on the Wabash, the Chicago and Eastern Illinois, and the Cleveland, Cincinnati, Chicago and Saint Louis railroads. It has coal-mining interests, foundries, and manufactures of woolen goods, glass, and bricks. Pop. 1900, 18,354.

DANVILLE, a borough and county-seat of Montour co., Pa., on the north branch of the Susquehanna River, 12 miles from its intersection with the West Branch, and on the Pennsylvania, the Lackawanna, and the Philadelphia and Reading railroads. Pop. 10,100.

DANVILLE, a city in Pittsylvania co., Va., 141 miles southwest of Richmond; on the Dan River and on railroads of the Southern Railway System. It was for a short time the seat of government of the Southern Confederacy during its last days. Pop. 17,424.

DAPH'NE, the Greek name for laurel, in Greek mythology a nymph beloved by Apollo. Deaf to the suit of the god, and fleeing from him, she besought Zeus to protect her. Her prayer was heard, and at the moment Apollo was about to encircle her in his arms she was changed into a laurel, a tree thenceforth consecrated to the god.

DARBHAN'GAH, a town of Hindustan, in the Patná division of Behar, in a low-lying district subject to inundation; it is the residence of the Maharaja of Darbhangah, who has a fine new palace here. Pop. 66,244.

DAR'DANELLES (-nelz), a narrow channel which connects the Sea of Marmora with the Grecian Archipelago, and at this particular point separates Europe from Asia. It is about 40 miles in length, and varies in breadth from 1 to 4 miles. On both shores there are numerous forts and batteries. Two castles on the opposite shores occupy the sites of ancient Sestos and Abydos, and recall the story of Hero and Leander. By treaty made in 1841 between the five great powers and Turkey, confirmed by the Peace of Paris in 1856, it is settled that no non-Turkish man-of war shall pass the strait without the express permission of the Turkish government.

DARFUR', or **DARFOOR',** a considerable region of Central Africa, forming a large oasis in the s.e. corner of the Great Desert. The inhabitants are Mohammedans and negroes, and semi-barbarous. Their occupation is chiefly agriculture, and cattle form their principal wealth. The commerce with Egypt is extensive, and is carried on entirely by the African system of caravans. It exports slaves, ivory, ostrich feathers, gum, copper, etc., and receives in exchange sugar, cotton cloth, hardware, fire-arms, etc. Unlimited polygamy is allowed, and the morals and manners of the natives are of a very degraded kind. Darfur is part of the Egyptian Soudan. Pop. estimated at 4,000,000.

DARIC, an ancient Persian gold coin of Darius, weighing about 129 grains, value about $6.00, and bearing on one side the figure of an archer. In later times the name has been applied to a silver coin having the figure of an archer.

Golden daric, from British museum.

DA'RIEN, Gulf of, a gulf of the Caribbean Sea at the north extremity of South America, between the Isthmus of Panamá and the mainland.

DARIEN, Isthmus of, often used as synonymous with the Isthmus of Panamá, but more strictly applied to the neck of land between the Gulf of Darien and the Pacific.

DARIEN SCHEME, a celebrated financial project, conceived and set afloat by William Paterson, a Scotchman, toward the close of the 17th century. He proposed to form an emporium on each side of the Isthmus of Darien or Panamá for the trade of the opposite continents. The settlement thus formed would become the entrepôt for an immense exchange between the manufactures of Europe and the produce of South America and Asia. In 1698 five large vessels laden with stores, etc., and with 1200 intending colonists, sailed for the Isthmus of Darien. The settlement was found in a suitable position, and the colonists fortified a secure and capacious harbor; but nothing else had been rightly calculated. For eight months the colony bore up, but at the end of that time the survivors were compelled by disease and famine to abandon their settlement and return to Europe. Two of the ships were lost on the way home, and only about thirty, including Paterson, reached Scotland.

DARI'US, the name of several Persian kings. (1) Darius I., fourth king of Persia, son of Hystaspes, a prince of the royal family of the Achæmenidæ, attained the throne in B.C. 521. His reign was distinguished by many important events. died B.C. 485.—(2) Darius II , ascended the throne in 423, and died in 404. His son Cyrus is familiar to us through Xenophon's Anabasis.—(3) Darius III., grandson of Darius II., was the twelfth and last king

of Persia. He ascended the throne B.C. 336, died 330 B.C.

DARJEEL'ING, a district of India, in the extreme north of the lieutenant-governorship of Bengal, division of Cooch-Behar; area, 1234 sq. miles. Tea, coffee, cinchona, and cotton are cultivated more or less, and the cultivation of the tea-plant and the making of tea is now the staple industry. Pop. 223,314. — Darjeeling, the chief town in the district, is a sanatory station for the British troops, and though little more than 36 miles from the plains stands at an elevation of 7400 feet above sea-level, on a ridge with deep valleys on either side, in a bleak but healthy situation. There is a residence of the lieutenant-governor, barracks, a sanitarium, etc. Pop. 13,037, much increased in the hot weather.

DARK HORSE, an American political term used to designate an unlooked-for, or comparatively unknown, candidate in a political convention who suddenly comes to the front and wins the nomination. The term originated in the story of the trotting race in which a dark horse, upon which nobody counted, turned up winner.

DARLING, Grace, a celebrated English heroine, was born in 1815 in the Longstone Lighthouse (Farne Islands, coast of Northumberland), of which her father was keeper. In 1838 the steamer Forfarshire, with forty-one passengers on board besides her crew, became disabled off the Farne Islands during a storm, and was thrown on a rock where she broke into two, part of the crew and passengers being left clinging to the wreck. Next morning William Darling descried them from Longstone, about a mile distant, but he shrank from attempting to reach the wreck through a boiling sea in a boat. His daughter Grace, however, implored him to make the attempt and let her accompany him. At last he consented, and father and daughter each taking an oar, they reached the wreck and succeeded in rescuing nine sufferers. The news of the heroic deed soon spread and the brave girl received testimonials from all quarters. Four years afterward she died of consumption, 20th October, 1842.

DARMSTADT (dârm'stât), Germany, capital of the Grand-duchy of Hesse, in a sandy plain, on the Darm, 15 miles s. Frankfort. Among the remarkable buildings are the old palace (with a library of 500,000 volumes and 4000 MSS., a picture-gallery, and a rich museum of natural history), the Roman Catholic Church, and the Rathhaus or town-hall, built in 1580. Pop. 56,399.

DARMSTADT, or **HESSE-DARMSTADT.** See Hesse.

DARN'LEY, Henry Stuart, Lord, son of the Earl of Lennox and Lady Margaret Douglas, a niece of Henry VIII., and by her first marriage queen of James IV., born 1541. In 1565 he was married to Mary Queen of Scots. It was an unfortunate match, and ere long gave rise first to coolness, then to open quarrel, and finally to deadly hate, which the murder of Rizzio, to which Darnley was a party, only increased. Mary affected, however, to be reconciled to him, but could not long conceal her contempt for the handsome imbecile. After the birth of a son, subsequently James VI., Darnley was seized at Glasgow with smallpox, from which he had barely recovered when Mary visited him, and had him conveyed to an isolated house called Kirk of Field, close to the Edinburgh city walls. This dwelling, which belonged to a retainer of Bothwell's, the rapidly rising favorite, was blown into the air with gunpowder (10th February, 1567). The dead bodies of the king and his page were found in a field at a distance of 80 yards from the house, quite free from any mark which such an explosion would cause. Strong circumstantial evidence points to Bothwell as the murderer, and to Mary as an accomplice in the crime.

DARRANG, an administrative district of Hindustan, forming a portion of the upper valley of the Brahmaputra, in the prov. of Assam; area, 3418 sq. miles; pop. 307, 761. Virgin forests cover a large portion of the region.

DARTMOOR', an extensive upland tract in England, in the western part of Devonshire, often called the Forest of Dartmoor, and belonging to the Duchy of Cornwall; reaching from Brent s., to Oakhampton n., 22 miles, with a breadth of about 20 miles, and occupying from 130,000 to 150,000 acres. Cattle and sheep are fed on the coarse grass during the summer months. Several of the rugged granite hills (here called tors) are of considerable height, Yes Tor rising 2050 feet above the plain. Dartmoor prison, built in 1809 as a state-prison, is now a convict depôt.

DARTMOOR MASSACRE, an incident of the war of 1812, in which a number of American prisoners in Dartmouth prison, England, were shot by a company of British troops. The charge was made that the Americans were at the bottom of a conspiracy to escape. The massacre was justified by a joint high commission, although the prisoners were found guiltless and the British government made ample provision for the injured and the families of the dead.

DARTMOUTH COLLEGE, situated at Hanover, N. H., and organized in 1750 at Lebanon, Conn. Besides the collegiate department there is a medical school, an engineering school, a finance school, and an agricultural school. There are 800 or more students and 90,000 volumes in the library.

DARTMOUTH COLLEGE CASE, an important law case concerning the charter of Dartmouth college. The charter was originally granted by Britain but in 1816 the New Hampshire legislature passed a law taking over the school. The Dartmouth trustees rejected the new charter and in this they were upheld by the decision of the supreme court.

DAR'WIN, Charles Robert, English naturalist, born at Shrewsbury in 1809, died at Down, near Beckenham in Kent, 1882. He early devoted himself to the study of natural history, and in 1831 he was appointed naturalist to the surveying voyage of H.M.S. Beagle. The vessel sailed in Dec. 1831, and did not return till Oct. 1836, after having circumnavigated the globe. In 1839 he married his cousin Emma Wedgwood. In 1859 his name attained its great celebrity by the publication of The Origin of Species by Means of Natural Selection. This work, scouted and derided though it was at first in certain quarters, may be said to have worked nothing less than a revolution in biological science. In it for the first time

Charles Darwin.

was given a full exposition of the theory of evolution as applied to plants and animals, the origin of species being explained on the hypothesis of natural selection. The rest of his works are largely based on the material he had accumulated for the elaboration of this great theory. Mr. Darwin was buried in Westminster Abbey.

DAR'WINISM, the views, especially regarding the origin and development of animals and plants, expressed in detail and advocated with much earnestness in the works of Charles Darwin. See Evolution, Natural Selection, etc.

DATE, that addition to a writing which specifies the year, month, and day when, and usually the place where, it was given or executed; also the time when any event happened, when anything was transacted, or when anything is to be done.

DATE, the fruit of the date-palm or the tree itself. The fruit is used extensively as an article of food by the natives of Northern Africa and of some countries of Asia. It consists of an external pericarp, separable into three portions, and covering a seed which is hard and horny in consequence of the nature of the albumen in which the embryo plant is buried. Next to the cocoanut tree the date is unquestionably the most interesting and useful of the palm tribe. Its stem shoots up to the height of 50 or 60 feet without branch or division, and of nearly the same thickness throughout its length. From the summit it throws out a magnificent crown of large feather-shaped leaves, and a number of spadices, each of which in the female plant bears a bunch of from 180 to 200 dates, each bunch weighing from 20 to 25 lbs. The fruit is eaten fresh or dried. Cakes of dates pounded and kneaded together are the food of the Arabs who traverse the deserts. A liquor resembling wine is made from dates by fermentation.

Persia, Palestine, Arabia, and the north of Africa are best adapted for the culture of the date-tree, and its fruit is in these countries an important article of food.

Date palm.

DATIA (*dat'-ia*), a native state in Bundelkhand, Hindustan, under the Central India Agency. Area, 836 sq. miles; pop. 186,440.—Datia, the chief town of the state, is situated 125 miles s.e. of Agra. Pop. 24,071.

DAUDET (dō-dā), Alphonse, French novelist, born at Nîmes 1840. He settled in Paris in 1857, and wrote poems, essays, plays, etc., without much success, till he discovered his powers as a novelist, when he speedily became famous. He died in 1897.

DAUGHTERS OF THE AMERICAN REVOLUTION, Society of, a patriotic society for women, organized in Washington, D.C., Oct. 11, 1890. Its purpose is to perpetuate traditions of the American Revolution and membership is restricted to female descendents of ancestors who aided the revolution. The society has from 40,000 to 50,000 members, scattered in state chapters throughout the Union.

DAUGHTERS OF THE CONFEDERACY, The United. (See Confederacy, United Daughters of).

DAUGHTERS OF THE KING, a Protestant Episcopal organization for women, organized in New York City in 1885 for the purpose of promoting work in the church. It has a membership of about 18,000.

DAUGHTERS OF THE REVOLUTION, Society of, a patriotic society for women, organized in New York City in 1891, with objects similar to those of the Daughters of the American Revolution, but with a membership restricted to lineal female descendents who by assisting the revolution because guilty of treason to Britain. The membership is about 5,000.

DAU'PHIN, the title of the eldest son of the King of France prior to the revolution of 1830, said to be derived from the dolphin, the crest of the lords of Dauphiny. The name was assumed towards the middle of the 9th century by the lord of Dauphiny, which province was bequeathed by Humbert II. to the King of France in 1349, on condition that the heir of the throne should bear the title of Dauphin of Viennois

DAVENPORT, a city of Iowa, on the Mississippi River about 300 miles north of St. Louis. Connecting it with Rock Island are two iron bridges built at a cost of $2,000,000. Davenport has splendid transportation facilities by water and rail. It has a public library, two theaters, several important educational institutions, and a number of large factories. The town was founded in 1851 by George Davenport. It has a population of 50,000.

DAVENPORT, Charles Benedict, an American zoologist born in Connecticut in 1866. He has written a number of monographs on zoological subjects.

DAVENPORT, Edward Loomis, an American actor, born in Boston in 1816, died in 1877. He made his first appearance at Providence, R. I., as Sir Giles Overreach and subsequently became noted as a most excellent interpreter of Shakespearean rôles.

DAVENPORT, Fanny Lily Gipsy, an American actress, daughter of E. L. Davenport, born in England in 1850, died in 1898. She began her stage career as a little girl, and by 1883 had appeared with great success in a variety of parts of wide range. In the last mentioned year she began to appear in Sardou's dramas in which she disclosed new power. She married Willet Melbourne Mac Dowell in 1889.

DAVID, King of Israel, the youngest son of Jesse, a citizen of Bethlehem, and descended through Boaz from the ancient princes of Judah. The life of David is recorded in the first and second books of Samuel and the first book of Chronicles. The book of Psalms, a large portion of which has been attributed to him (see Psalms), also contains frequent allusions to incidents in his life. He reigned from 1055 B.C. to 1015 B.C., according to the usual chronology, but recent investigations put the dates of David's reign from 30 to 50 years later. Under David the empire of the Israelites rose to the height of its power, and his reign has always been looked on by the Jews as the golden age of their nation's history.

DAVID I., King of Scotland, son of Malcolm Canmore; born about 1080; succeeded his brother Alexander I. in 1124; died 1153. He was the first to introduce feudal institutions and ideas into his native land.

DAVID II., King of Scotland, son of Robert Bruce, born 1322; succeeded to the throne 1329; died 1370.

DAVID, Jacques Louis, the founder of the modern French school of painting, born at Paris 1748, died at Brussels 1825. What is considered his masterpiece, The Rape of the Sabines, was painted in 1799. He was appointed first painter to Napoleon about 1804; and after the second restoration of Louis XVIII. he was included in the decree which banished all regicides from France, when he retired to Brussels.

DAVID, Pierre Jean, a French sculptor, born at Angers in 1789 (hence commonly called David d'Angers), died 1856. In 1831 he began the magnificent sculptures of the Pantheon, his most important work, which he finished in 1837. He executed a great number of medallions, busts, and statues of celebrated persons of all countries, among whom we may mention Walter Scott, Canning, Washington, Lafayette, Guttenberg, Cuvier, Victor Hugo, Béranger, Paganini, and Madame de Staël.

DAVIS, Jefferson, president of the Confederate States of America during the civil war; born in Kentucky 1808. He was trained at West Point Military

Jefferson Davis.

Academy, and from 1828 to 1835 saw a good deal of service on the frontier. At the latter date he became a cotton planter in the State of Mississippi. He was elected to congress in 1845, but at the commencement of the Mexican war he left congress and engaged actively in the contest. He entered the senate in 1847, and held various posts in the government, upholding the policy of the slave states and the doctrine of slave rights. On the outbreak of the civil war he was chosen president of the Southern States, was taken prisoner after the fall of Richmond, imprisoned for two years in Fortress Monroe, and set at liberty by the general amnesty of 1868. He subsequently wrote a history of the war. He died in 1889.

DAVIS, John Chandler Bancroft, an American diplomat, born in Massachusetts in 1822. He was an agent of the United States in the Alabama claims case and was minister to Germany from 1874 to 1877.

DAVIS, John D., an American oriental scholar, born in Pennsylvania in 1854. He has published (1898) a Dictionary of the Bible, and (1894) Genesis and Shemitic Tradition.

DAVIS, Nathan Smith, an American physician born in New York in 1817, and educated in the College of Physicians and Surgeons of Western New York. He was the projector and founder of the American Medical Association in 1845 and soon afterward removed to Chicago where he become associated with the

Rush Medical College. He became noted as an advocate of teetotalism.

DAVIS, Rebecca Harding, an American writer, born in 1831 in Pennsylvania. She has written several short stories which have received considerable praise.

DAVIS, Richard Harding, an American editor and short story writer, born in Philadelphia in 1864. He was for a time editor of Harper's Weekly and in 1891 published his first successful short story book called Gallagher and Other Stories. This was followed by numerous other such books, and a number of books made up of descriptive articles previously published in magazines. His style is vigorous and interesting.

DAVIS, Varina Anne Jefferson, daughter of Jefferson Davis, born in Richmond, Va., in 1864, died in 1898. She was known as "The Daughter of the Confederacy."

DAVIS, William Morris, an American astronomer and meteorologist, born in Philadelphia in 1850. He has been for many years a teacher at Harvard University.

DAVIS' STRAIT, a narrow sea which separates Greenland from Baffin's Land, and unites Baffin's Bay with the Atlantic Ocean; lat. 60° to 70° n.

DA'VITS, two projecting pieces of wood or iron on the side or stern of a vessel, used for suspending or lowering and hoisting the boats by means of sheave and pulley. They are fixed so as to admit of being shipped and unshipped at pleasure.

DA'VITT, Michael, an Irish patriot, politician and parliamentarian, born in Mayo in 1846. He began his career as a journalist, began anti-landlord agitation in 1867 and was several times elected member of parliament. Davitt visited the U. States on a number of occasions to raise money for the Irish cause. He was one of Parnell's most bitter opponents. He died in 1906.

DA'VY, Sir Humphry, Bart., distinguished English chemist, was born at

Sir Humphry Davy.

Penzance, 1778, died at Geneva 1829. His discoveries with the galvanic battery, his decomposition of the earths and alkalies and ascertaining their metallic bases, his demonstration of the simple nature of the oxymuriatic acid (to which he gave the name of chlorine), etc., obtained him an extensive reputation; and in 1810 received the prize of the French Institute. The numerous accidents arising from fire-damp in mines led him to enter upon a series of experiments on the nature of the explosive gas, the result of which was the invention of his safety-lamp. He was knighted in 1812, and created a baronet in 1818.

DAVY-LAMP. See Safety-lamp.

DAW, or JACKDAW; a bird of the crow family, found in Europe, Asia and Africa; 14 inches long, black, with a smoky-gray neck. Daws are very cun-

Daw, or jackdaw.

ning, social, and active birds, often nesting in church-towers and old castles. They build a nest of sticks, of which they sometimes collect a large quantity

DAY, either the interval of time during which the sun is continuously above the horizon, or the time occupied by a revolution of the earth on its axis, embracing this interval (the period of light) as well as the interval of darkness. The day in the latter sense may be measured in more than one way. If we measure it by the apparent movement of the stars, caused by the rotation of the earth on its axis, we must call day the period between the time when a star is on the meridian and when it again returns to the meridian; this is a sidereal day. It is uniformly equal to 23 hours, 56 minutes, 4 098 seconds. But more important than this is the solar day, or the interval between two passages of the sun across the meridian of any place. The latter is about 4 minutes longer than the former, owing to the revolution of the earth round the sun, and it is not of uniform length, owing to the varying speed at which the earth moves in its orbit and to the obliquity of the ecliptic. For convenience an average of the solar day is taken, and this gives us the mean solar or civil day of 24 hours, the difference between which and the actual solar day at any time is the equation of time.

The length of the days and nights at any place varies with the latitude and season of the year, owing to the inclination of the earth's axis. In the first place, the days and nights are equal (twelve hours each) all over the world on the 21st of March and the 21st of September, which dates are called the vernal (spring) and autumnal equinoxes (Lat. æquus, equal; nox, night). Again, the days and nights are always of equal length at the equator, which, for this reason, is sometimes called the equinoctial line. With these exceptions, we find the difference between the duration of the day and the night varying more and more as we recede from the equator. This will be easily understood from a consideration of the accompanying figure, which represents the position of the earth at the northern summer solstice. Let s a, s'd, s"b represent the sun's rays, then the vertical circle a f b g will be the circle of illumination, that is, the line which separates the illuminated and dark hemispheres of the earth. Consider a place f. As the earth turns round it would describe a circle f d g h, the greater part of which, f d g, is performed in the sunlight, and the smaller part, g h f, in the dark. In other words, the day for the place f would be longer than its night. It will be also seen that for any place within the Arctic circle a k the sun does not set, while in the Antarctic circle the sun never rises so long as the earth is in this position. At the northern winter solstice the reverse of all this is the case—the Arctic circle never comes into the light area, and places within the Antarctic circle never enter into the dark. From this it will be seen that at both poles the year consists of one day of six months' duration, and one night of the same length.

The Babylonians began the day at sun-rising; the Jews at sun-setting; the Egyptians and Romans at midnight, as do most modern peoples. The civil day in most countries is divided into two portions of twelve hours each. The abbreviations p.m. and a. m. (the first signifying postmeridian, Latin for afternoon; the latter antemeridian, forenoon) are requisite, in consequence of this division of the day. The Italians in some places reckon the day from sunset to sunset, and enumerate the hours up to twenty-four; the Chinese divide it into twelve parts of two hours each. For astronomical purposes the day is divided into twenty-four hours instead of two parts of twelve hours. Formerly it began at noon, but since 1st Jan. 1885, the day of twenty-four hours begins at midnight at Greenwich Observatory; and this reckoning is now generally adopted for astronomical purposes elsewhere than at

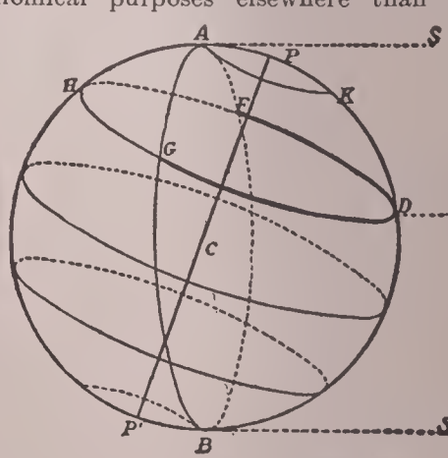


Diagram to illustrate the differences in the length of day and night.

Greenwich. The Greenwich day practically determines the date for all the world. At mid-day at Greenwich the date (day of the week and month) is everywhere the same, though there are

all possible differences in naming the hour of the day. But mid-day at Greenwich is the only instant at which we ever have the same date all over the world. The meridian of midnight, which is then at 180° e. or w., goes on revolving, gradually bringing a new date to every place to the west of that line, but obviously not bringing that new date to the places immediately to the east of that line till twenty-four hours after. From this it follows that whereas places on the one side of the globe never have a different date except when midnight lies between them, places on the opposite side of the globe, and on different sides of the meridian of 180° e. or w., never have the same date except when midnight lies between them. The actual difference of time between Wellington in New Zealand and Honolulu in the Sandwich Islands is only about 2 hours; yet a person at Wellington may date a letter 9 o'clock a. m. 26th June, while another writing at the same instant at Honolulu dates his 11 o'clock a. m. 25th June.

DAY, William Rufus, an American jurist and statesman, born in Ohio in 1849, studied law, and in 1897 was appointed assistant secretary of state, and subsequently secretary of state in succession to John Sherman. In 1899 he was made judge of the sixth circuit of the U. States circuit court.

DAY-BOOK, a journal of accounts; a book in which are recorded the debts and credits or accounts of the day. See Book-keeping.

DAYS OF GRACE are days allowed for the payment of a promissory note or bill of exchange after it becomes due. The time varies in different countries.

DAYTON, a town in Ohio, capital of Montgomery county, at the confluence of the Mad and Great Miami rivers, 52 miles n.e. of Cincinnati. It is a place of great industrial activity, a center of railway communication, and in the variety and extent of its manufactures it stands in the front rank of western towns of its size. The National Home for Disabled Soldiers and Sailors is situated here. The city is laid out with wide streets adorned with numerous handsome buildings. There is a Greek courthouse, a fine high school, several hospitals, and a public library. Pop. 130,000.

DEACON, ecclesiastically, a person in the lowest degree of holy orders. The office of deacon was instituted by the apostles, and seven persons were chosen at first to serve at the feasts of Christians, and distribute bread and wine to the communicants, and to minister to the wants of the poor. In the Roman Catholic Church the deacon is the chief minister at the altar. He assists the priest in the celebration of mass, and on certain conditions can preach and baptize. In the Church of England the deacon is the lowest of the three orders of priesthood, these being bishops, priests, and deacons. The deacon may perform all the ordinary offices of the Christian priesthood except consecrating the elements at the administration of the Lord's Supper, and pronouncing the absolution. In Presbyterian churches the deacon's office is to attend to the secular interests, and in Independent churches it is the same, with the addition that he has to distribute the bread and wine to the communicants.

DEAD, BOOK OF THE, a name applied to a number of texts and other writings in the religious system of Egypt. The origin of the name lay in the belief of the ancient Egyptians that this book, or these texts were of great assistance to the dead in the wandering of their souls in the spiritual world. The book was placed in the coffin with the dead person, or under his arm.

DEAD-LETTER, a letter which lies for a certain period uncalled for at the post-office, or one which cannot be delivered from defect of address, and which is sent to the general post-office at Washington to be opened and returned to the writer. The department which deals with such letters is now called the Returned Letter Office.

DEAD RECKONING, the calculation of a ship's place at sea without any observation of the heavenly bodies. It is obtained by keeping an account of the distance which the ship has run by the log, and of her course steered by the compass, and by rectifying these data by the usual allowance for drift, leeway, etc., according to the ship's known trim.

DEAD SEA, a celebrated lake in Asiatic Turkey, near the south extremity of Palestine, in the pashalic of Damasus. The basin or hollow in which the Dead Sea reposes forms the south termination of the great depression through which the Jordan flows, that river entering it at its north extremity. It receives several other tributaries, but has no outlet. The surface is 1312 feet below the level of the Mediterranean, and 984 feet below Lake Tiberias, from which the Jordan issues. It lies deeply imbedded between lofty cliffs of naked limestone, its shores presenting a scene of indescribable desolation and solitude, encompassed by desert sands, and bleak, strong salt hills. Sulphur and rock salt, lava, and pumice, abound along its shores. The water is nauseous to the taste and smell, and so buoyant that the human body will not sink in it. At about a third of its length from the north end it attains a maximum depth of 1308 feet. The southern portion is a mere lagoon, 12 feet deep in the middle and 3 at the edges.

DEAF AND DUMB, or Deaf-mutes, persons both deaf and dumb, the dumbness resulting from deafness which has either existed from birth or from a very early period of life. Such persons are unable to speak simply because they have not the guidance of the sense of hearing to enable them to imitate sounds. Among the causes assigned for congenital deafness are consanguineous marriages, hereditary transmission, scrofula, certain local or climatic conditions, ill health of the mother during pregnancy, etc. Acquired or accidental deafness, which occurs at all ages, is frequently due to such diseases as smallpox, measles, typhus, paralysis, hydrocephalus, and other cerebral affections, but more particularly to scarlet fever, which is somewhat apt to leave the patient deaf owing to the inflammatory state of the throat extending to the internal ear, and thus causing suppuration and destruction of the extremely delicate parts of the auditory apparatus. In the greater proportion of deaf-mutes no defect is visible, or can be detected by anatomical examination, and no applications yet discovered appear to be

One-handed alphabet.

useful. The necessity of communication, and the want of words, oblige the deaf-mute to observe and imitate the actions and expressions which accompany various states of mind and of feeling, to indicate objects by their appearance and use, and persons by some peculiar mark, and to describe their actions by direct imitation. In this way he and his friends are led to form a dialect of that universal language of attitude, gesture, and expression which becomes a substitute for words in the hands of the pantomimic actor, and which adds force and clearness to the finest effusions of the orator; in other words, the natural sign language. This language, in its elements, is to be found among all nations, and has ever been the medium of communication between voyagers and the natives of newly discovered countries. It is employed by many savage tribes to supply the paucity of expression in their language and to communicate with other tribes. Among some of the Indians of North America it exists as a highly-organized language Such a means of communication is after all very imperfect, however, and various more perfect systems have been devised to enable deaf-mutes to communicate with one another and with the rest of mankind, and thus to gain such an education as people in general possess. In 1648 John Bulwer published the earliest work in English on the instruction of the deaf and dumb. This was followed by Dalgarno's Ars Signorum (Art of Signs) in 1661, and Dr. W. D. Holder's Elements of Speech. Dalgarno, who was a native of Scotland, likewise published, in 1680, Didascalocophus; or. the Deaf and Dumb Man's Tutor, a work of considerable merit.

To Dr. John Wallis, however, Savilian professor of mathematics at Oxford, is generally ascribed the merit of having been the first Englishman who succeeded in imparting instruction to deaf-mutes. In 1743 the practicability of instructing deaf-mutes was first publicly demonstrated in France by Pereira, a Spaniard, before the Academy of Sciences, which gave its testimony to the success of the method. About the same time the Abbé de L'Epée, who devoted his life and fortune to this subject, introduced a system for the instruction of the deaf and dumb, which was taught with great success in the Royal Parisian Institution, and afterward still further

Two-handed alphabet.

developed by his pupil and successor, the Abbé Sicard. In 1779 a public institution for the education of deaf-mutes was established at Leipzig, through the labors of Samuel Heinicke, the great upholder of the vocal or articulatory system, which is still retained at Vienna and throughout Germany. About twenty years previously Thomas Braidwood had established near Edinburgh in 1760 a deaf and dumb school on the articulating system, which was visited by Dr. Johnson during his tour in Scotland. The first public institution in Great Britain for the gratuitous education of the deaf and dumb was founded at Bermondsey in 1792 by the Rev. Messrs. Townsend and Mason. From this establishment originated the London Asylum in Kent Road, which was opened in 1807. In 1810 a school for affording instruction gratuitously to the dumb was founded in Edinburgh, and others of a similar description were subsequently established at Birmingham, Glasgow, Manchester, and other towns. An association for the oral instruction of the deaf and dumb was founded in London in 1871.

The two chief methods of conveying instruction to the deaf and dumb are by means of the manual alphabet, and by training them to watch the lips of the teacher during articulation. There are two kinds of manual alphabet: the double-handed alphabet, where the letters are expressed by the disposition of the fingers of both hands; and the single-handed, in which the letters are formed with the fingers of one hand. Particular gestures which are attached to each word as its distinctive sign are largely used, as are also real objects and models, pictures, etc. The method of teaching by articulation, the pupil learning to recognize words, and in time to utter them, by closely watching the motions of the lips and tongue in speech, and by being instructed through diagrams as to the different positions of the vocal organs, is now receiving much attention, and has given excellent results, cases being known where persons have conversed with the deaf and dumb and remained ignorant that those to whom they were speaking were afflicted in this way. It is by no means a novel system, but of late it has vastly increased in favor with authorities. A new mode of teaching articulation has recently been brought into notice, consisting in the use of the system of visible speech devised by Mr. Melville Bell. The characters of the alphabet on which this system is founded are intended to reveal to the eye the position of the vocal organs in the formation of any sound which the human mouth can utter. Its practical value as a means of instruction with all classes of the deaf and dumb has not as yet been sufficiently tested.

DEAFNESS, the partial or total inability to hear. This is a symptom of most affections of the ear. It may be due simply to an accumulation of wax. If it come on suddenly without pain in a healthy person this is probably the cause. When it comes on with a cold in the head it is the result of a cold or catarrh, and is likely to pass off in a few days. Attended by pain, ringing in the ears, etc., some degree of inflammation is likely present. The most intractable form of deafness comes on very gradually and painlessly, and is connected with disease of the middle ear. If a skilled ear-surgeon were consulted in time much might probably be done to stay its progress. Deafness due to the disease of the nerve of hearing is usually very intense, comes on suddenly or advances very rapidly, and is not easily reached by treatment. As to other causes of complete deafness see Deaf and Dumb.

DEAL, the division of a piece of timber made by sawing; a board or plank. The name deal is chiefly applied to boards of fir above 7 inches in width and of various lengths exceeding 6 feet. If 7 inches or less wide they are called battens, and when under 6 feet long they are called deal-ends. The usual thickness is 3 inches, and width 9 inches. The standard size, to which other sizes may be reduced, is 1½ inch thick, 11 inches broad, and 12 feet long. Whole deal is deal which is 1½ inch thick; slit deal, half that thickness.

DEAN, an ecclesiastical dignitary, said to have been so called because he presided over ten canons or prebendaries; but more probably because each diocese was divided into deaneries, each comprising ten parishes or churches, and with a dean presiding over each.

DEAN OF FACULTY.—(1) In some universities, as that of London and those of Scotland, the chief or head of a faculty (as of arts, law, or medicine); in the United States, a registrar or secretary of the faculty in a department of a college, as in a medical, theological, or scientific department. (2) The president for the time being of an incorporation of barristers or law practitioners; specifically, the president of the incorporation of advocates in Edinburgh.

DEATH is that state of a being, animal or vegetable, but more particularly of an animal, in which there is a total and permanent cessation of all the vital functions, when the organs have not only ceased to act, but have lost the susceptibility of renewed action. Death takes place either from the natural decay of the organism, as in old age, or from derangements or lesions of the vital organs caused by disease or injury. The signs of actual death in a human being are the cessation of breathing and the beating of the heart; insensibility of the eye to light, pallor of the body, complete muscular relaxation, succeeded by a statue-like stiffness or rigidity which lasts from one to nine days; and decomposition, which begins to take place after the rigidity has yielded, beginning first in the lower portion of the body and gradually extending to the chest and face. What becomes of the mind or thinking principle, in man or animal, after death, is a matter of philosophical conjecture or religious faith.

DEATH, Dance of, a grotesque allegorical representation in which the figure of Death, generally in the form of a skeleton, is represented interrupting people of every condition and in all situations, and carrying them away; so called from the mocking activity usually displayed by the figure of Death as he leads away his victims.

DEATH-RATE, the proportion of deaths among the inhabitants of a town, country, etc. In the U. S. it is usually calculated at so many per thousand per annum.

DEATH VALLEY, a stretch of desert in Inyo County, Cal., surrounded by four small ranges of mountains. The length of the valley is about 150 miles and its breadth from 10 to 20 miles. Its lowest level is nearly 500 feet below the level of the sea. The soil is destitute of vegetation, the temperature rises to 122 degrees Fahr. in the shade, and sand storms are common. The desert is occupied by reptiles only.

DEATH-WATCH, the popular name of the insect that inhabits the woodwork of houses. In calling to one another they make a peculiar ticking sound, which superstition has interpreted as a forerunner of death.

Death-watch beetle—1, Natural size. 2, Magnified. 3, Head as seen from underneath.

DECLARATION OF PARIS, an agreement defining the regulations of maritime war, which was signed at Paris April 16, 1856, by France, Britain, Austria, Prussia, Russia, Turkey, and Sardinia. By it privateering was abolished, neutral goods under enemy's flag cannot be captured, and blockades must be effective in order to be binding. These rules are still in force and were observed during the late Spanish American war.

DECLARATION OR AFFIRMATION, SOLEMN, terms applied to the asseveration made by a witness who, for any reason, declines taking the oath. Although the oath is not administered in such cases, violation of the affirmation constitute perjury.

DECLINATION, in astronomy, the distance of a heavenly body from the celestial equator (equinoctial), measured on a great circle passing through the pole and also through the body. It is said to be north or south according as the body is north or south of the equator. Great circles passing through the poles, and cutting the equator at right angles, are called circles of declination. Twenty four circles of declination, dividing the equator into twenty-four arcs of 15° each, are called hour circles or horary circles —Declination of the compass or needle, or magnetic declination, is the variation of the magnetic needle from the true meridian of a place. This is different at different places, and at the same place at different times. The declination at London was 11° 15′ e. in 1576, 0° in 1652, 19° 30′ w. in 1760, 24° 27′ w., its maximum, in 1815, 21° 6′ w. in 1865, 19° 15′ w. in 1870, and 17° 4′ in 1894.

DECOMPOSITION, Chemical, is the separation of the constituents of a body from one another. Roughly speaking—for it is a difference of degree rather than of kind—decomposition is either artificial or spontaneous. Artificial decomposition is produced in bodies by the action of heat, light, electricity or chemical reagents; spontaneous, in bodies which quickly undergo change in ordinary circumstances, unless special precautions are taken to preserve them. The bodies of the mineral, and the definite crystallized principles of the organic world, belong to the first; organized matter, such as animal and vegetable tissues, organic fluids, such as blood, milk, bile, and the complex non-crystallized bodies, albumen, gelatine, emulsine, etc., belong to the second.

DEC′ORATED STYLE, in architecture, the second style of pointed (Gothic) architecture, in use in Britain from the end of the 13th to the beginning of the 15th century, when it passed into the Perpendicular. It is distinguished from the Early English, from which it was developed, by the more flowing or wavy lines of its tracery, especially of its windows, by the more graceful combinations of its foliage, by the greater richness of the decorations of the capitals of its columns, and of the moldings of its doorways and niches, finials, etc., and generally by a style of ornamentation more profuse and naturalistic, though perhaps somewhat florid. The most distinctive ornament of the style is the ball-flower, which is usually inserted in a hollow molding. The Decorated style has been divided into two periods, viz. the Early or Geometrical Decorated period, in which geometrical figures are largely introduced in the ornamentation; and the Decorated style proper, in which the peculiar characteristics of the style are exhibited. To this latter period belong some of the finest monuments of British architecture.

Decorated style—York cathedral, west front.

DECORATION DAY, a memorial day, May 30, observed in the northern states by decorating with flowers the graves of soldiers who perished in the civil war. It is observed in the south by decorating the graves of the confederate dead.

DECREE′, in general, an order, edict, or law made by a superior as a rule to govern inferiors. In law it is a judicial decision or determination of a litigated cause.

DEDICA′TION, the act of consecrating something to a divine being, or to a sacred use, often with religious solemnities. Also an address prefixed to a book, and formerly inscribed to a patron, testifying respect and recommending the work to his protection and favor; now chiefly addressed to friends of the author, or to public characters, simply as a mark of affection or esteem.

DEDUC′TION, in reasoning, the act or method of drawing inferences, or of deducing conclusions from premises; or that which is drawn from premises. See Logic.

DEED, in law, a writing containing some contract or agreement, and the evidence of its execution, made between parties legally capable of entering into a contract or agreement; particularly an instrument on paper or parchment, conveying real estate to a purchaser or donee.

DEEM′STER, an officer formerly attached to the high court of justiciary in Scotland, who formally pronounced the doom or sentence of death on condemned criminals. The office was conjoined with that of executioner. The name is now given in the Isle of Man to two judges who act as the chief-justices of the island, the one presiding over the northern, the other over the southern division. They hold courts weekly at Douglas, Ramsey, and other places.

DEEP SEA EXPLORATION, investigation of the physical and organic conditions at the bottom of the sea. This kind of investigation had its systematic beginnings in 1873 with the Challenger expedition backed by the British government. Since that time much of interest has been discovered by various explorations. The deepest sounding was that at Guam, of nearly six miles. Deep sea dredging has disclosed numerous forms of life unknown before.

DEER, a general name for the ungulate or hoofed ruminating animals constituting the family Cervidæ, of which the typical genus is the stag or red-deer. The distinguishing characteristics of the genus are, that the members of it have solid branching horns which they shed every year, and eight cutting teeth in the lower jaw and none in the upper. The horns or antlers always exist on the head of the male, and sometimes on that of the female. The forms of the horns are various; sometimes they spread into broad palms which send out sharp snags around their outer edges; sometimes they divide fantastically into branches, some of which project over the forehead, whilst others are reared upward in the air; or they may be so reclined backward that the animal seems almost forced to carry its head in a stiff erect posture. They are used as defensive and offensive weapons, and grow with great rapidity. There are many species of deer, as the red-deer or stag, the fallow-deer, the roebuck, the reindeer, the moose, the elk. Deer are pretty widely distributed over the world though there are none in Australia and few in Africa, where the antelopes (whose horns are permanent) take their place. The rein deer alone has been domesticated.

Blacktail, or mule-deer.

DEERHOUND. See Staghound.

DEER-MOUSE, the common name of the animals belonging to an American genus of rodent animals allied to the mice and the jerboas of the Old World. The deer-mouse of Canada is a pretty animal of the size of a mouse, with very long hind-legs and tail, and very short fore-legs.

DEER-STALKING, an exciting but laborious mode of hunting the red-deer, in which, on account of the extreme shyness of the game, their far-sightedness and keen sense of smell, they have to be approached by cautious maneuvering before a chance of obtaining a shot oc-

curs. Great patience and tact and a thorough knowledge of the ground are essential to a good stalker, who has to undergo many discomforts in crouching, creeping, wading through bogs, etc. Advance from higher to lower ground is usually made, since the deer are always apt to look to the low ground as the source of danger. "Deer-driving" toward a point where the shooters are concealed is often practiced, but is looked on as poor sport by the true deer-stalker.

DE FACTO, a legal term meaning in very fact, as opposed to de jure, which means by legal right. The exercise of de facto authority is always a usurpation.

DEFAMATION OF CHARACTER, the publication or circulation of a report injurious to the character or reputation of a person. It is actionable when damage has been done the individual defamed.

DEFAULT', in law, signifies generally any neglect or omission to do something which ought to be done. Its special application is to the non-appearance of a defendant in court when duly summoned on an appointed day. If he fail to appear judgment may be demanded and given against him by default.

DEFEND'ANT, in law, the party against whom a complaint, demand, or charge is brought; one who is summoned into court, and defends, denies, or opposes the demand or charge, and maintains his own right. The term is applied even if the party admits the claim.

DEFENDER OF THE FAITH, a title belonging to the King of England, as Catholicus to the King of Spain, Christianissimus to the King of France, etc. Leo X. bestowed the title of Defender of the Faith on Henry VIII. in 1521, on account of his book against Luther, and the title has been used by the sovereigns of England ever since.

DEFENSE, in law, the repulsion of an attack on the person, the property, or the family of an individual. There are certain limitations to the rights which vary in different states.

DEFILE, a narrow passage or way in which troops may march only in a file, or with a narrow front; a long narrow pass, as between hills, etc.

DEFINITION, a brief and precise description of a thing by its properties; an explanation of the signification of a word or term, or of what a word is understood to express.

DEFOE (dē-fō'), Daniel, an English writer of great ingenuity and fertility, was born in 1661 in London. In 1719 appeared the most popular of all his writings: The Life and Surprising Adventures of Robinson Crusoe, the favorable reception of which was immediate and universal. The success of Defoe in this performance induced him to write a number of other lives and adventures in character; as Moll Flanders, Captain Singleton, Roxana, Duncan Campbell, The Memoirs of a Cavalier, Journal of the Plague, etc. He died in London in 1731.

DEFORCEMENT, in law, the holding of lands or tenements to which another person has a right; a general term including any species of wrong by which he who has a right to the freehold is kept out of possession. In Scots law, it is the resisting of an officer in the execution of law.

DEFORMITY, a malformation whether congenital or not, which mars the symmetry of the body. It was formerly believed that congenital deformities, so called birth marks, were produced by shocks to the mind of the mother while bearing young. This idea is wholly false. The child is never affected in this way by the mental state of the mother. Strawberry marks, and other fancied resemblances of that kind, are due to causes entirely apart from the mother's "state of mind." These stories are chiefly old women's tales.

DEGENERACY, a very loose, unscientific term used to describe any state of mind or body which deviates highly from the normal type. Results of atavism, reversion to ancestral type, effects of nutrition, and numerous other and more obscure traits have been called degenerate. The term degeneracy has also been applied to epilepsy in its thousand forms. The use of the term is confusing and leads to unending misunderstanding.

DEGREDATION, the ecclesiastical censure by which a clergyman is divested of his holy orders.

DEGREE', in geometry or trigonometry, the 360th part of the circumference of any circle, the circumference of every circle being supposed to be divided into 360 equal parts, called degrees. A degree of latitude is the 360th part of the earth's circumference north or south of the equator, measured on a great circle at right angles to the equator, and a degree of longitude the same part of the surface east or west of any given meridian, measured on a circle parallel to the equator. Degrees are marked by a small ° near the top of the last figure of the number which expresses them; thus 45° is 45 degrees. The degree is subdivided into sixty equal parts called minutes; and the minute is again subdivided into sixty equal parts called seconds. Thus, 45° 12′ 20″ means 45 degrees, 12 minutes, and 20 seconds. The magnitude or quantity of angles is estimated in degrees and parts of a degree, because equal angles at the center of a circle are subtended by equal arcs, and equal angles at the centers of different circles are subtended by similar arcs, or arcs containing the same number of degrees and parts of a degrees. An angle is said to be so many degrees as are contained in the arc of any circle intercepted between the lines which contain the angle, the angular point being the center of the circle. Thus we say an angle of 90°, or of 45° 24′. It is also usual to say that a star is elevated so many degrees above the horizon, or declines so many degrees from the equator, or such a town is situated in so many degrees of latitude or longitude. The length of a degree depends upon the radius of the circle of the circumference of which it is a part, the length being greater the greater the length of the radius. Hence the length of a degree of longitude is greatest at the equator, and diminishes continually toward the poles, at which it = 0. Under the equator a degree of longitude contains 60 geographical, and 69½ statute miles. The degrees of latitude are found to increase in length from the equator to the poles, owing to the figure of the earth. Numerous measurements have been made in order to determine accurately the length of degrees of latitude and longitude at different parts of the earth's surface and thus settle its dimensions and magnitude. When the French determined to establish their system of measures and weights based upon the mètre (see Decimal System), they settled that this basis was to be the ten-millionth part of the distance from the equator to the pole, which distance had to be found by accurate measurement. Ten degrees of latitude were accordingly measured, from Dunkirk to Formentera, one of the Balearic islands. Similar measurements having been made in Britain, the length of a total arc of twenty degrees has been found. Many measurements have also been made elsewhere. The term is also applied to the divisions, spaces, or intervals marked on a mathematical, meteorological, or other instrument, as a thermometer or barometer.

DEGREE, in universities, a mark of distinction conferred on students, members, or distinguished strangers, as a testimony of their proficiency in the arts or sciences, or as a mark of respect, the former known as ordinary, the latter as honorary degrees. The degrees are bachelor, master, and doctor, and are conferred (though not all of them) in arts, letters or literature, science, medicine, surgery, law, philosophy, divinity, and music. Various universities now admit women to degrees.

DEGREE, in algebra, a term used in speaking of equations, to express what is the highest power of the unknown quantity. Thus if the index of that power be 3 or 4 (x^3, y^4), the equation is respectively of the third or fourth degree.

DEHORNING, the art of depriving cattle of their horns. It is done by a huge pair of clippers, and although painful to the animal, works out a great saving in the long run by preventing the animals from injuring one another. After the operation the animal becomes docile. The horn does not regenerate.

DEI GRATIA (dē'ī grā'shi-a), a formula which sovereigns add to their title. The expression is taken from several apostolical expressions in the New Testament.

DE'ISM, a philosophical system which, as opposed to Atheism, recognizes a great First Cause; as opposed to Pantheism, a Supreme Being distinct from nature or the universe; while, as opposed to Theism, it looks upon God as wholly apart from the concerns of this world. It thus implies a disbelief in revelation, skepticism as regards the value of miraculous evidence, and an assumption that the light of nature and reason are the only guides in doctrine and practice. It is thus a phase of Rationalism. In the 18th century there were a series of writers who are spoken of distinctively as the English deists. They include Collins, Toland, Tindal, etc.

DE KOVEN, Henry Louis Reginald, an American song and light opera writer, born in Connecticut in 1859. He studied music in Europe and in 1882 settled in Chicago where he wrote and produced Robin Hood, The Begum, The Fencing Master, Rob Roy, The Highwayman, Maid Marian and other small operas.

DELACROIX (dė-lå-krwä), Ferdinand Victor Eugène, an eminent French painter, born 1799, died 1863. He is considered the chief of the modern French romantic school of painters. His chief pictures up to 1830 are: Dante and Virgil in the Infernal Regions, Massacre in Scio, the Execution of the Doge Marino Falieri, the Death of Sardanapalus, the Murder of the Bishop of Liège. In 1831 he joined the embassy sent by Louis Philippe to the Emperor of Morocco. To this journey we are indebted for several pictures remarkable for their vivid realization of oriental life as well as their masterly coloring. They are: The Jewish Marriage, Muley Abderrhaman With His Body-guard, Algerian Ladies in Their Chamber, Moorish Soldiers at Exercise, and several scenes of common life. He decorated several of the public buildings of Paris, and was admitted into the Institute in 1857.

DELAGO'A BAY, in Southeast Africa, a large sheet of water partly separated from the Indian Ocean by the peninsula and island of Inyack. The bay stretches north and south upward of 40 miles, with a breadth of from 16 to 20 miles, and is situated near the southern extremity of the Portuguese possessions here, which surround it.

DELAROCHE (dė-lå-rosh), Hippolyte, probably the greatest painter of the French school, born in Paris in 1797, died 1856. He studied landscape-painting for a short time, but applied himself

Hippolyte Delaroche.

afterward to historical painting, and rapidly rose to eminence. His subjects are principally taken from French and English history. His merits consist in correct drawing, appropriate expression, harmonious color, and great distinctness and perspicuity in treatment, rendering the story of his pictures at once intelligible. He held a middle place between the classical and the romantic schools, and is regarded as the leader of the so-called "eclectic school."

DEL'AWARE, a river of the United States, which rises in Catskill Mountains in New York, separates Pennsylvania from New York and New Jersey, and New Jersey from Delaware, and loses itself in Delaware Bay. It has a course of about 300 miles, and is navigable for smaller craft to the head of tidewater at Trenton (155 miles).

DELAWARE, one of the original thirteen United States of North America, and, next, to Rhode Island, the smallest state in the Union, named after Lord Delaware, one of the early gover-

nors of Virginia. It is bounded north by Pennsylvania, east by the Delaware River and Bay and by the ocean, south and west by Maryland; area, 2120 square miles. It is divided into three counties, Kent, Newcastle, and Sussex, and has nearly the form of a right-angled triangle (hence its popular name "the diamond state"). In the south and toward the coast the surface is very level, but the north part is rather hilly. An elevated swampy table-land toward the west traverses the state, forming the water-shed between the Bay of Chesapeake and the Delaware.

Situated on the eastern coast of the continent, Delaware has a temperate climate, with a considerable range of temperature and an ample rainfall.

The soils are sedimentary, derived from the underlying tertiary rocks. In the rolling northern portion of the state the soil is clay, passing through the various gradations from a heavy clay to a loamy clay, and is well adapted to raising fruits, grasses, grains. In the undulating middle section, approximately covered by Kent County, the soil is generally loamy. Here fruits, berries, vegetables, and the vine flourish. In the flat southern section of Sussex County the soil is sandy, with here and there outcrops of loamy clay. This region is best adapted for strawberry and peach culture, and the canning and drying of fruits are important industries.

Agriculture is the leading industry, farms constituting 85 per cent of the total land surface. During the last half-century there has been a continuous and marked increase in the number of farms, and a corresponding decrease in the average size.

In no state have fertilizers become so generally used, the average amount per farm ($55.65) being three times that for the North Atlantic states. There has been a marked increase during the decade in the two principal crops—corn and wheat. The wheat acreage is several times that for all the New England states. The other cereals are relatively unimportant. The oats crop has decreased to one-third the acreage of 1890. Hay ranks third in acreage. Orchard and small fruits have long constituted one of the main sources of income.

The manufacturing industry employs over 22,000 people, and rivals agriculture in importance. The falls near the mouth of the Brandywine have been, from an early date extensively utilized for manufacturing purposes. The manufacture of iron and steel products leads in importance. This industry includes steel and rolling mills, car-shops, foundry and machine shops, and ship-building yards.

A number of the trunk lines connecting the East with the South and West pass through the northern part of the state. Chesapeake and Delaware bays are connected by a canal 13½ miles long, 66 feet wide, and 10 feet deep. This work was completed in 1829, at a cost of $2,250,000. The massive breakwater at Lewes was begun in 1828, and completed in 1869, at a cost of over $2,000,000. There is some foreign commerce direct through Wilmington, but such trade is generally through Baltimore or some northern port. The coasting trade is important, especially with New York, with which Wilmington is connected by a line of steamers. Wilmington is a customs district, and there are deputy collectors at New Castle and Lewes. The capital is Dover. In National elections the state in 1888 and 1892 went Democratic; in 1896, 1900, 1904 and 1908, Republican. Pop. 1909, 200,000.

DELAWARE, a city and the county-seat of Delaware County, Ohio, 24 miles north of Columbus, on the Whetstone (Olentangy) River, and on the Cleveland, Cincinnati, Chicago and Saint Louis, the Columbus, Sandusky and Hocking, and the Columbus, Hocking Valley and Toledo railroads. Population, 11,000.

DELAWARE BAY, an estuary or arm of the sea between the states of Delaware and New Jersey. At the entrance, near Cape Henlopen, is situated the Delaware Breakwater, which affords vessels a shelter within the cape. It was erected by the Federal government and cost about $300,000.

DELAWARE COLLEGE, founded at Newark, Del., in 1833. It has an annual income of $45.000 and a library of 13,000 volumes. There is also here a valuable government agricultural experiment station.

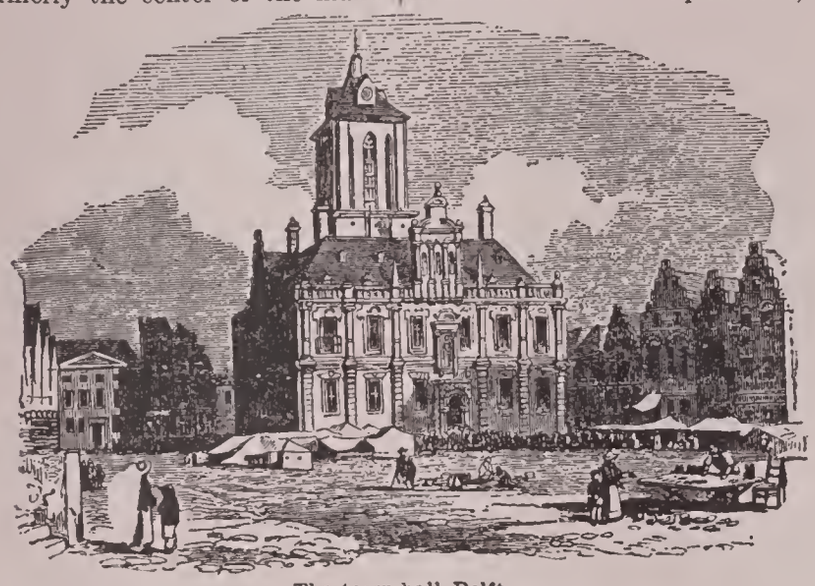
DELAWARE INDIANS, a tribe belonging to the Algonquin family, originally known as living on the Delaware river, and called by themselves Lenni Lenape. They had to leave their original settlements about the middle of last century, going farther west, and latterly they were removed to the Indian Territory. Their numbers are now insignificant.

DELAWARE WATER GAP, a gorge in the Appalachian chain near Stroudsburg, Pa. The Delaware River flows through it, 1400 feet below the top of the sides of the gorge.

DEL'EGATE, a person appointed and sent by another or by others, with

powers to transact business as his or their representative. The title was given to members of the first continental congress in America, 1774. Representatives to congress from the U. S. territories are still designated by this term. They have the right of discussion, but have no vote.

DELFT, formerly Delf, a town, Holland, 8 miles n.w Rotterdam, intersected in all directions by canals. Delft was formerly the center of the manufacture of the pottery called delft-ware; its chief industries now embrace carpets, leather, soap, oil, gin, etc. Pop. 27,131.



The town-hall, Delft.

DELFT-WARE, or Delf, is a kind of pottery covered with an enamel or white glazing which gives it the appearance of porcelain. It was originally manufactured in Delft in the 14th century, is now considered coarse, but was among the best of its day.

DELHI (del'i), a city of Hindustan, in the Punjab, anciently capital of the Patan and Mogul Empires, about 954 miles n.w. Calcutta. It was at one time the largest city in Hindustan, covering a space of 20 square miles, and having a population of 2,000,000. A vast tract covered with the ruins of palaces, pavilions, baths, gardens, mausoleums, etc., marks the extent of the ancient metropolis. The present city abuts on the right bank of the Jumna, and is surrounded on three sides by a lofty stone wall 5½ miles long. The palace or residence of the Great Mogul, built by Shah Jehan, commenced in 1631, and now known as "the fort," is situated in the east of the city, and abuts directly on the river. It is surrounded on three sides by an embattled wall of reddish sandstone nearly 60 feet high, with round towers at intervals, and a gateway on the west and south. Since the mutiny in 1857 a great portion has been demolished in order to make room for military barracks. One of the most remarkable objects in the city is the Jamma Musjid or Great Mosque, a magnificent structure in the Byzantine-Arabic style, built by the Emperor Shah Jehan in the 17th century. The East Indian Railway enters the city by a bridge over the Jumna. The s.w. quarter of the town is densely occupied by the shops and dwellings of the native population; the streets are narrow and turtuous, but some of the main thoroughfares of the city are splendid streets, the chief being the Chandni Chauk, or Silver Street. During the mutiny Delhi was seized by the Sepoys, who held possession for four months, during which many atrocities were committed. Pop. 208,385.

DELIQUES'CENCE, a change of form from the solid to the liquid state, by the absorption of moisture from the atmosphere. It occurs in many bodies, such as caustic potash, carbonate of potassium, acetate of potassium, chloride of calcium, chloride of copper, chloride of zinc, etc.

DELIR'IUM, a temporary disordered state of the mental faculties occurring during illness either of a febrile or of an exhausting nature. It may be the effect of disordered or inflammatory action affecting the brain itself, or it may be sympathetic with active disease in other parts of the body, as the heart; it may be caused by long-continued and exhausting pain, and by a state of inanition of the nervous system.

DELIR'IUM TRE'MENS, an affection of the brain which arises from the inordinate and protracted use of ardent spirits. It is therefore almost peculiar to drunkards. The principal symptoms of this disease, as its name imports, are delirium and trembling. The delirium is a constant symptom, but the tremor is not always present, or, if present is not always perceptible. Frequently the sufferer thinks he sees the most frightful, grotesque, or extraordinary objects, and may thus be put into a state of extreme terror. It is properly a disease of the nervous system. The common treatment is to administer soporifics so as to get the patient to sleep.

DE LONG, George Washington, an American explorer and naval officer, born in New York City in 1844, died in 1881. He was an officer of the Juniata when that ship went to search for the Polaris in 1873. He commanded the Jeanette in her polar expedition of 1879 and perished of starvation in that expedition. His body was found in 1882.

DE'LOS, an island of great renown among the ancient Greeks, fabled to be the birthplace of Apollo. It was a center of his worship, and the site of a famous oracle. It is the central and smallest island of the Cyclades, in the Ægean Sea, a rugged mass of granite about 12 square miles in extent. Abundant ruins of its former magnificence yet exist, and excavations resulting in interesting archæological discoveries have recently been made.

DELPHI, an ancient Greek town, originally called Pytho, the seat of the famous oracle of Apollo, was situated in Phocis, on the southern side of Parnassus, about 8 miles north of the Corinthian Gulf. It was also one of the meeting-places of the Amphictyonic Council, and near it were held the Pythian games. The oracles were delivered by the mouth of a priestess who was seated on a tripod above a subterranean opening, whence she received the vapors ascending from beneath, and with them the inspiration of the Delphian god. The oracular replies were always obscure and ambiguous; yet they served, in earlier times, in the hands of the priests, to regulate and uphold the political, civil and religious relations of Greece.

DELTA, the name of the Greek letter Δ, answering to the English D. The island formed by the alluvial deposits between the mouths of the Nile, from its resemblance to this letter, was named Delta by the Greeks; and the same name has since been extended to those alluvial tracts at the mouths of great rivers which, like the Nile, empty themselves into the sea by two or more diverging branches.

DEL'UGE, the universal inundation which, according to the Mosaic history, took place to punish the great iniquity of mankind. It was produced, according to Genesis, by a rain of forty days; and covered the earth 15 cubits above the tops of the highest mountains, and killed every living creature except Noah, with his family, and the animals which entered the ark by the command of God. Many other nations mention, in the mythological or prehistoric part of their history, inundations which, in their essential particulars, agree with the Scriptural account of Noah's preservation, each nation localizing the chief events and actors as connected with itself.

DEMAGOGUE (dem'a-gog), originally simply one who leans or directs the people in political matters; now it usually means one who acquires influence with the populace by pandering to their prejudices or playing on their ignorance.

DEMAND AND SUPPLY, the law which, it was formerly believed, regulated prices. Price really determines demand, not the reverse. The whole quantity of goods in the market represents the demand for goods in the market. Demand and desire for goods are not the same thing. Demand is desire for commodities plus the ability to pay. When the supply of a commodity is large, the price is low and the demand great. When the supply is small the price is high and the demand small.

DEMEN'TIA, a form of insanity in which unconnected and imperfectly defined ideas chase each other rapidly through the mind, the powers of continued attention and reflection being lost. It often implies such general feebleness of the mental faculties as may occur in old age.

DEMERA'RA, or Demarara, a division of British Guiana, which derives its name from the river Demarara or Demerara. It extends about 100 miles along the coast, lying on the east of Essequibo and on the west of Berbice. The soil is very fertile, producing abundant crops of sugar, coffee, cotton, rice, etc. Chief town, Georgetown. Pop. of province, 125,000.—The river, after a course of about 120 miles, flows into the Atlantic.

DEMESNE (de-mān'), or Domain, in law, a manor-house and the land adjacent or near, which a lord keeps in his own hands or immediate occupation, for the use of his family, as distinguished from his tenemental lands, distributed among his tenants.

DEMET'RIUS, or **DMITRI,** the name of a series of impostors who usurped supreme authority in Russia, and led to some of its remarkable revolutions.

DEMET'RIUS, king af ancient Macedonia, son of Antigonus, a successor of Alexander the Great, was born about B.C. 339, and died in Syria 283 B.C.

DEMI-MONDE, an expression first used by the younger Dumas in a drama of the same name (first performed in 1855), to denote that class of gay female adventurers who are only half-acknowledged in society; popularly, disreputable female society; courtezans.

DEMISE', in law, a grant by lease; it is applied to an estate either in fee-simple, fee-tail, or for a term of life or years. As applied to the crown of England, demise signifies its transmission to the next heir on being laid down by the sovereign at death.

DEMISEMIQUAVER, in music, half a semiquaver, or the thirty second part of a semibreve.

DEMOC'RACY, the rule of a people by the people themselves; that form of government in which the sovereignty of the state is vested in the people, and exercised by them either directly, as in the small republics of ancient Greece, or indirectly, by means of representative institutions, as in the constitutional states of modern times. The term is also applied in a collective sense to the people or populace, especially the populace regarded as rulers. See also next article.

DEM'OCRAT, one who adheres to democracy. In the U. States, a member of one of the two great political parties into which that country is divided; opposed to republican. The main features of their system of principles are decentralization and self-government of the states.

DEMOC'RITUS, a Greek philosopher of the new Eleatic school, a native of Abdēra, who was born between 470 and 460 B.C. He explained the origin of the world by the eternal motion of an infinite number of invisible and indivisible bodies or atoms, which differ from one another in form, position, and arrangement, and which have a primary motion, which brings them into contact, and forms innumerable combinations, the result of which is seen in the productions and phenomena of nature. In this way the universe was formed, fortuitously, without the interposition of a First Cause. The eternal existence of atoms (of matter in general) he inferred from the consideration that time could be conceived only as eternal and without beginning. He applied his atomical theory, also, to natural philosophy and astronomy. Even the gods he considered to have arisen from atoms, and to be perishable like the rest of things existing. In his ethical philosophy Democritus considered the acquisition of peace of mind as the highest aim of existence. He is said to have written a great deal; but nothing has come to us except a few fragments. He died 370 B.C., at an advanced age. His school was supplanted by that of Epicurus.

DE'MON, a spirit or immaterial being of supernatural but limited powers, especially an evil or malignant spirit. Among the ancient Greeks the name was given to beings similar to those spiritual existences called angels in the Bible. In the New Testament evil spirits are called demons (commonly translated "devils"). A belief in demons is found in the oldest religions of the East. Buddhism reckons six classes of beings in the universe: two, gods and men, are accounted good; the other four are malignant spirits. The Persians and the Egyptians had also a complete system of demons; and in Europe, up till the middle ages, the divinities of oriental, classical, and Scandinavian mythology often figure, from the Christian point of view, as evil spirits. In later times phases of demonology may be seen in the witchcraft mania and the spiritualism of the present day.

DEMO'NIAC, a person whose mental faculties are overpowered, and whose body is possessed and actuated by some created spiritual being; especially a person possessed of or controlled by evil spirits. The New Testament has many narratives of demoniacs, and various opinions are entertained in regard to the character of their affliction.

DEMONOLOGY, the science which studies the various beliefs and superstitions of men concerning the existence of personal devils, or evil powers invisible to human eyes, but exerting an important influence or human affairs. Demons have existed in the beliefs of all peoples and do still exist in the belief of many. Faith in a personal devil is one of the scriptural qualifications of a Christian, however much the idea may be ridiculed by modern teachers. Numerous works have been written upon the science of demonology. (See Demon).

DEMONSTRATION, in a logical sense, any mode of connecting a conclusion with its premises, or an effect with its cause. In a more rigorous sense it is applied only to those modes of proof in which the conclusion necessarily follows from the premises. In ordinary language, however, demonstration is often used as synonymous with proof.

DEMOS'THENES (-nēz), the famous ancient Greek orator. He was born in 382 (according to some in 385) B.C. He thundered against Philip of Macedon in his orations known as the Philippics, and endeavored to instil into his fellow-citizens the hatred which animated his own bosom. He labored to get all the Greeks to combine against the encroachments of Philip, but their want of patriotism and Macedonian gold frustrated his efforts. He was present at the battle of Chæroneia (380 B.C.), in which the Athenians and Bœotians were defeated by Philip, and Greek liberty crushed. On the accession of Alexander in 336 Demosthenes tried to stir up a general rising against the Macedonians, but Alexander at once adopted measures of extreme severity, and Athens sued for mercy. It was with difficulty that Demosthenes escaped being delivered up to the conqueror. In 324 he was imprisoned on a false charge of having received a bribe from one of Alexander's generals, but managed to escape into exile. On the death of Alexander next year he was recalled, but the defeat of the Greeks by Antipater caused him to seek refuge in the temple of Poseidon, in the island of Calauria, on the coast of Greece, where he poisoned himself to escape from the emissaries of Antipater (322 B.C.). The character of Demosthenes is by most modern scholars considered almost spotless. His fame as an orator is equal to that of Homer as a poet. Cicero pronounces him to be the most perfect of all orators. He carried Greek prose to a degree of perfection which it never before had reached. Everything in his speeches is natural, vigorous, concise, symmetrical

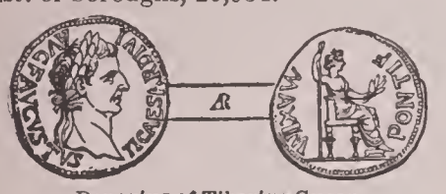
DEMURR'AGE, in maritime law, the time during which a vessel is detained by the freighter beyond that originally stipulated, in loading or unloading. When a vessel is thus detained she is said to be on demurrage. The name is also given to the compensation which the freighter has to pay for such delay or detention. Demurrage must be paid though it be proved the delay is inevitable; but it cannot be claimed where it arises from detention by an enemy, tempestuous weather, or through the fault of the owner, captain, or crew. The term is applied also to detention of freight by railroads.

DEMURRER, in law, a stop at some point in the pleadings, and a resting of the decision of the cause on that point; an issue on matter of law. A demurrer confesses the fact or facts to be true, but denies the sufficiency of the facts in point of law to support the claim or defense.

DEMY', a size of writing paper 16x21 inches intervening between cap 14x17 inches and folio 17x22 inches. Printing demy measures 24x36 inches. Double demy is 36x48 inches.

DENARIUS, a Roman silver coin worth 10 asses or 10 lbs. of copper originally, and afterward considered equal to 16 asses, when the weight of the as was reduced to an ounce on account of the scarcity of silver. The denarius was equivalent to about 15 cents There was also a gold denarius equal in value to 25 silver ones.

DENBIGH (den'bi), a county of North Wales, on the Irish Sea; area, 392,005 acres, of which about a fourth is arable. Barley, oats, and potatoes are grown on the uplands; and in the rich valleys wheat, beans, and pease. Cattle and sheep are reared, and dairy husbandry is carried on to a considerable extent. The minerals consist of lead, iron, coal, freestone, slate, and millstone. Flannels, coarse cloths, and stockings are manufactured. The principal rivers are the Clwyd, the Dee, and the Conway. Pop. 129,933.—The county town Denbigh is a municipal and parliamentary borough near the center of the Vale of Clwyd, 25 miles w. of Chester. Pop. 6439; of dist. of boroughs, 26,934.



Denarius of Tiberius Cæsar.

DEN'DRITE, a stone or mineral, on or in which are figures resembling shrubs, trees, or mosses. The appearance is due to arborescent crystallization, resembling the frostwork on our windows. The figures generally appear on the surfaces of fissures and in joints in rocks, and are attributable to the presence of the hydrous oxide of manganese, which generally assumes such a form.

DENIS, St., a town in France, department of the Seine, 6 miles north of Paris, lying within the lines of forts surrounding the capital. It contains the famous abbey church of St. Denis, a noble Gothic structure in part dating from the 11th century or earlier. The church is about 354 feet long and 92 high. The town has tanneries, breweries, manufactories of calicoes, gelatine, soda, etc. Pop. 50,992.

DENISON, a city in Grayson county, Tex., 72 miles north by east of Dallas, on the Missouri, Kansas and Texas, the Texas and Pacific, the Houston and Texas Central, and the Saint Louis and San Francisco railroads. Pop. 13,510.

DEN'MARK, a northern kingdom of Europe, consisting of a peninsular portion called Jutland, and an extensive archipelago lying east of it and comprising the islands of Seeland (or Själland), Fünen (or Fyen), Laaland (or Lolland), Falster, Langeland, Möen, Samsö, Lasö, Arrö, Bornholm, and many smaller ones. Besides these there are the outlying possessions of Iceland, Greenland, and the Faroe Islands in the Atlantic Ocean, and Santa Cruz, St. Thomas, and St. John in the West Indies. The area of the home possessions is 15,388 sq. miles of which Jutland occupies 9755; the pop. in 1908, 2,585,660. Including Iceland, part of Greenland, etc., the total area of the Danish possessions is 102,022 sq. miles; pop. 2,706,550. Copenhagen is the capital. For administrative purposes Denmark is divided into eighteen provinces or districts, besides the capital, nine of these making up Jutland, while the others embrace the islands.

On the south Denmark is bounded by Germany and the Baltic; on the west it is washed by the North Sea; northward it is separated from Norway by the Skagerrack; eastward it is separated from Sweden by the Kattegat and the Sound. Denmark, whether insular or mainland, is a very low-lying country, the eastern side of Jutland where the highest elevation occurs, not exceeding 550 feet. The country was once covered with great forests. but these have disappeared, and Denmark is largely dependent on other countries for her supplies of timber. Woods of some extent still exist, however, especially in the islands. In earliest perhistoric times (the stone age) the Scotch fir was the prevailing tree and subsequently the oak. The principal tree now is the beech, the oak forming but a small portion of the timber of Denmark. The elm, ash, willow, aspen, and birch are met with in small numbers or singly. Pine forests have been planted in the north of Jutland and elsewhere. Denmark has numerous streams but no large rivers; the principal is the Guden, which flows northeast through Jutland into the Kattegat. It is navigable for part of its course. The lakes are very numerous but not large, none exceeding 5½ miles in length by about 1½ miles broad. Copenhagen, Aalborg, Aarhuus, and Randers are the chief seaports. Owing to the lowness of the

Danish mansion—Castle on the island of Fünen.

land and its proximity to the sea on all sides, the climate is remarkably temperate for so northerly a region, though the thermometer in winter may sink to 22° below zero, and in summer rise to 89°. Violent winds are frequent, and rains and fogs prevalent, but the climate is favorable to vegetation.

The agricultural land is greatly subdivided, as the law interdicts the union of small farms into larger. Among crops the greatest area is occupied by oats, which are grown all over the country, but best in Jutland. Barley is grown chiefly in Seeland, and is largely used in brewing beer, the common beverage of the country. Rye is extensively raised, and the greater part of the bread used in Denmark is made from it. Turnips, beans, pease, flax, hemp, hops, tobacco, etc., are also grown; but in general cattle-breeding, grazing, and the dairy take up most of the farmers' attention in Denmark.

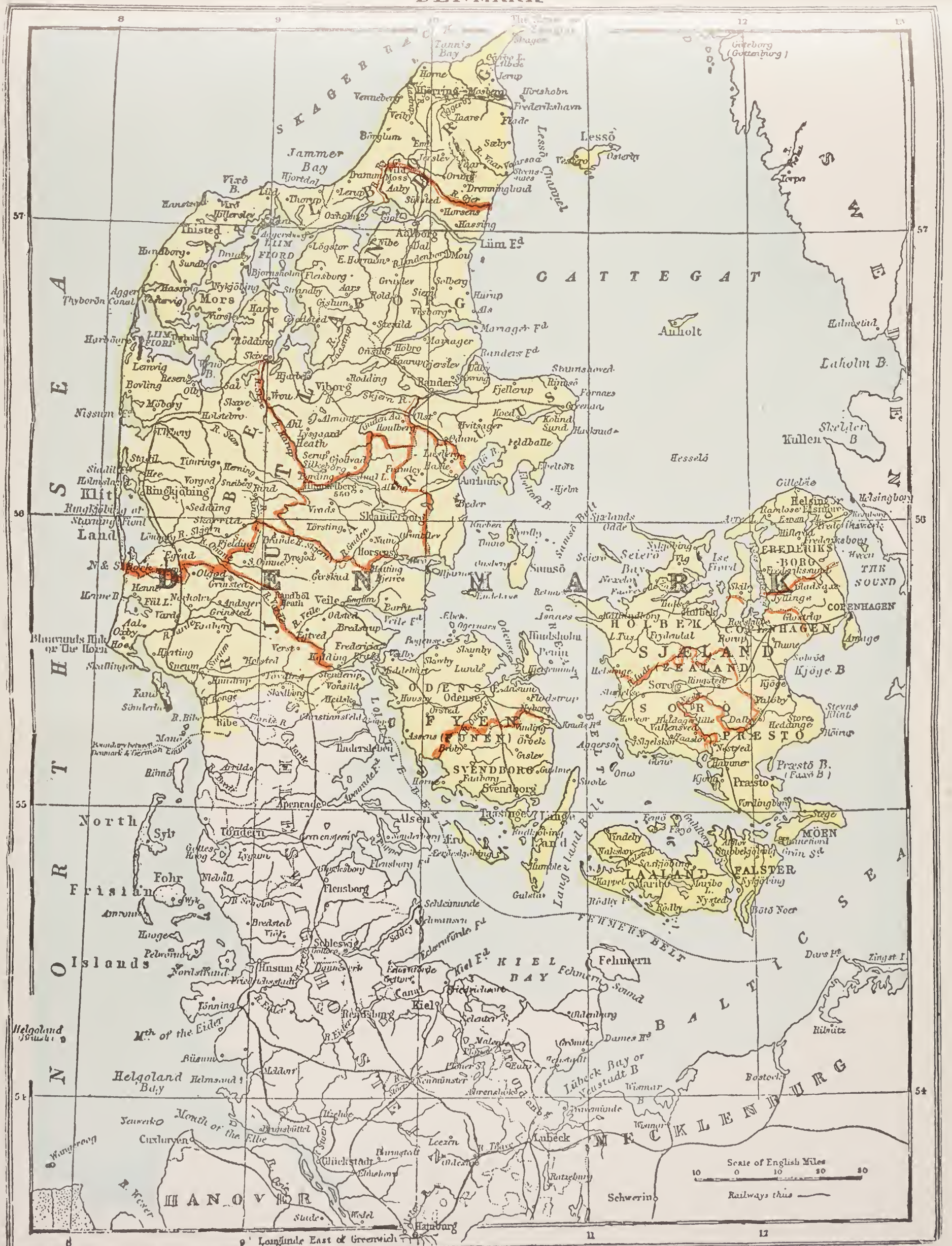
The commerce of Denmark is carried on chiefly with Great Britain, Germany, Norway, Sweden, and Russia, Great Britain possessing the larger share, and Germany coming a little behind her. The chief imports are textile manufactures, metal goods, coal, timber, oil, coffee, sugar, tobacco, fruit, etc. The chief exports are butter (the most important item), cattle, horses, and swine, bacon, grain, hides, eggs, and other edibles. The Danish mercantile marine has a total tonnage of about 416,500 tons. The railways have a length of about 1300 miles.

The population of Denmark is composed almost exclusively of Danes, with a few thousand Jews and others. The Danes have regular features, fair or brownish hair, and blue eyes. At the head of the educational institutions stand the University of Copenhagen and the Holberg Academy at Soröe. The provinces are well supplied with gymnasia and middle schools, and primary instruction is given at the public expense in the parochial schools. It is rare to meet a peasant who cannot read and write even among the poorer class.

The government of Denmark was originally an elective monarchy. In 1661 it became a hereditary and absolute monarchy, and in 1849 a hereditary constitutional one, the legislative power being in the king and diet jointly. The diet or Rigsdag consists of two chambers, the Landsthing or upper house, the Folkething or lower house. The army consists of all the able bodied young men of the kingdom who have arrived at the age of twenty-one years. The time of service is eight years in the regular troops, and afterward eight more in the reserve. Every corps has to drill for thirty to forty-five days every year. The army on a war footing has a total strength of about 60,000 men. The navy is of no great strength.

History.—The oldest inhabitants of Denmark whom we find mentioned by name were the Cimbri, who dwelt in the peninsula of Jutland, the Chersonesus Cimbrica of the Romans. They first struck terror into the Romans by their incursion, with the Teutones, into the rich provinces of Gaul (113–101 B.C.). After this, led by the mysterious Odin, the Goths broke into Scandinavia, and appointed chiefs from their own nation over Denmark, Norway, and Sweden. For a considerable time Denmark was divided into a number of small states, whose inhabitants lived mostly by piracy along the neighboring coasts. In 787 they began to make their descents on the eastern coasts of England, and along with other inhabitants of Scandinavia they conquered Normandy in 876–7. Under Gorm the Old all the small Danish states were united in 920, and his grandson Sweyn, now the head of a powerful kingdom, commenced the conquest of Norway and of England, which was ultimately completed by his son Canute. Canute died in 1035, leaving a powerful kingdom to his successors, who, in 1042, lost England, and in 1047 Norway. In 1047 Sweyn Magnus Estridsen ascended the throne, but with the exception of

DENMARK


SKAGERRAK
Tannis Bay
Jammer Bay
Thisted
Hanstedt
Virt
Hjørtdal
Lild
Thorup
Hundborg
Sundby
Thyborön Canal
Agger
Nykjöbing
Mors
Harre
Gjöstrup
Lemvig
Bovling
Nissum Fd
Skive
Viborg
Skjern R.
Holstebro
Ahl
Lysgaard Heath
Almindt
Gudenaa
Haulberg
Ringkjöbing
Ringkjöbing at Stauning Fiord
Land
Sedding
Vorgod
Tiuring
Hee
Skarrild
Vrads
Skanderborg
Törsting
Ejsing
Ejsbjerg
Horsens
Hatting
Bjerre
Olgod
Grinsted
Henne
Fiil L.
Nedsholm
Andsager
Varde
Aal
Oxby
Hoe
Blaavands Huk or The Horn
Skallingen
Fanö
Skönderup
Ribe
R. Bibe
Manø
Rönnö
Aarild
Apenrade
North Sea
Syl
Tönder
Gottes Hoog
Lygum
Fohr
Mebüll
Friesian Islands
Wyk
Amrum
Hooge
Pelworm
Nordstrand
Husum
Bredstedt
Tönning
R. Eider
Mth of the Eider
Helgoland
Büsum
Helgoland Bay
Meldorf
Heide
Seewerke
Mouth of the Elbe
Cuxhaven
Wangeroog
R. Weser
HANOVER
Glückstadt
Elmshorn
Burmstedt
Stade
Wedel
Hamburg
Rendsburg
Kiel
Kiel Fd
KIEL BAY
Canal
Holtenau
Friedrichsort
Schleswig
Schleimünde
Flensburg
Flensburg Fd
Apenrade Fd
Alsen
Sönderborg
Gulstav
Langeland Belt
Tasinge
Svendborg
Svendborg Sund
Fyen
Odense
Nyborg
Kjerteminde
Assens
Broby
Ærøskjöbing
Ærö
Marstal
Gulstav
Rudkjöbing
Langeland
Rudkjöbing Fd
Ringe
Ringe Fd
Nyborg Fd
Kjerteminde Fd
Odense Fd
Hindsholm
Great Belt
Korsör
Slagelse
Skelskör
Korsör Nor
Nyköbing
Nyköbing Fd
Isefiord
Roskilde
Roskilde Fd
Kallundborg
Holbek
Fjedenal
Ringsted
Sorö
Soröe
Kjöge
Kjöge B.
Valby
Store Heddinge
Præstö
Præstö B.
Faxö B.
Faxö
Vordingborg
Stege
Möen
Möens Klint
Thune
Amager
Copenhagen
Gladsaxe
Lyngby
Gjentofte
Hellerup
Skovshoved
Charlottenlund
Dragör
Saltholm
Kjöge Bay
Stevns Klint
Hvide Sande
Ringkjöbing Fd
Lemvig
Nissum Fd
Thyborön Canal
Hanstholm
Skagen
Skagen Odde
Tannis Bay
Horne
Varnæsbo
Horshobn
Frederikshavn
Veilby
Taars
Flade
Bönglum
Sæby
Lesso
Lesso Channel
Vesterö
Osterö
Jerpe
Sweden
Gothenburg (Göteborg)
Jammer Bay
Virö B.
Lild
Thorup
Hjörtdal
Lerup
Aaby
Drammelund
Horsens
Hassing
Aalborg
Lim Fd
Lögstör
Nibe
Dal
Mou
E. Hornum
R. Lindenborg
Fleisburg
Grinslev
Selberg
Hurup
Aars
Roldal
Sierup
Gishum
Vibyborg
Gjedsted
Sterild
Marnager Fd
Marnager
Randers Fd
Randers
Hobro
Onsild
Taarup
Gjerslev
Udby
Stavning
Rimsö
Fjellerup
Staunshoved
Fornæs
Grenaa
Kolind Sund
Havknud
Hvitsager
Feldballe
Ebeltoft
Hjelm
Anholt
Laholm B.
Hesselö
Kullen
Skerlder B
Helsingör
Helsingborg
Ramlose
Esrum
Fredensborg
Hillerod
Fredriksværk
Gilleleie
Frederiksborg
Fredriksborg
Hven
The Sound
Elsinore
Gladsaxe
Lyngby
Copenhagen
Amager
Saltholm
Dragör
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Nyköbing Fd
Isefiord
Roskilde
Roskilde Fd
Kallundborg
Holbek
Fjedenal
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Faxö
Vordingborg
Stege
Möen
Möens Klint

the great Waldemar the new dynasty furnished no worthy ruler, and the power of the kingdom decayed considerably till the accession of the politic Queen Margaret in 1387, who established the union of Calmar in 1397 uniting under her rule Denmark, Sweden, and Norway. In 1448 Christian I., count of Oldenburg was elected to the throne, thus founding the royal family of Oldenburg, which kept possession of the throne till 1863. Under the rule of Christina, Norway, Sweden, Schleswig, and Holstein were connected with the crown of Denmark, but under his successor Christian II. Sweden established its independence. Under Frederick I. (1523–33) the reformation was introduced. Christian IV. of Denmark ascended the throne in 1588, took part in the Thirty Years' war, and engaged twice in a war with Sweden, with most unfortunate results. Frederick III. again engaging in war with Sweden in 1657 was equally unsuccessful, Christian V. and Frederick IV. were conquered in the war with Charles XII. Denmark, however, after the fall of Charles XII., gained by the Peace of 1720 the toll on the Sound, and maintained possession of Schleswig. After this Denmark enjoyed a long repose. In 1800, having acceded to the northern confederacy, the kingdom was involved in a war with Great Britain, in which the Danish fleet was defeated at Copenhagen April 2, 1801. In 1807, there being reason to think that Denmark would join the alliance with France, a British fleet was sent up the Sound to demand a defensive alliance or the surrender of the Danish fleet as a pledge of neutrality. Both were denied, till the Danish capital was bombarded and forced to capitulate, the whole fleet being delivered up to the British. The war, however, was continued, Denmark forming new alliances with Napoleon till 1814, when a peace was concluded by which she ceded Heligoland to England in exchange for the Danish West India Islands, and Norway to Sweden in exchange for Swedish Pomerania and Rügen, which, however, she shortly after surrendered to Prussia, receiving in return Lauenburg and a pecuniary compensation. In June 1815 the king entered into the German confederacy as representing Holstein and Lauenburg. In 1848 Schleswig and Holstein revolted and were not finally subdued till 1852. In 1857 the Sound dues were abolished. Frederick VII. died in 1863 and with him the Oldenburg line became extinct. He was succeeded by Christian IX. (Prince of Sonderburg-Glücksburg). At the commencement of 1864 the Danish territory was politically distributed into four parts, viz. Denmark Proper (consisting of the Danish islands and North Jutland), the duchy of Schleswig or South Jutland, with a population more than one-half Danish, the remainder Frisian and German; the duchy of Lauenburg, also German. The measures of the Danish government compelling the use of the Danish language in state schools having given great umbrage to the German population of the duchies, the disputes resulted in the intervention of the German confederation, and ultimately Holstein was occupied by the troops of Austria and Prussia (1864). After a short campaign the Prussians captured Alsen, overran the greater part of Jutland, and forced the Danes to accept a peace (Aug. 1), by which they renounced their right to the duchies of Schleswig, Holstein, and Lauenburg. A difference now arose between Austria and Prussia as to what should be done with the duchies, and Prussia showing an evident intention of annexing them, the result was a war between the two powers, which ended in the total defeat of Austria at Sadowa, or Königgrätz, 3d July, 1866. By the treaty which followed Austria relinquished all claim to the duchies, which thus fell to Prussia. The chief events since then have been the prolonged struggle between the government and the Folkething; the celebration of the centenary of the emancipation of the Danish peasants and the jubilee of King Christian (1888) and the strengthening of the national defenses. King Christian died in 1906 and was succeeded by his son, Frederick VIII.

DENNISON, William, an American cabinet officer and governor, born in Cincinnati in 1815, died in 1882. He was governor of Ohio during the civil war and raised 30,000 troops for the Union side. He was postmaster-general in the cabinets of Lincoln and Johnson.

DENOUEMENT (dā-nö-mäṅ), a French term naturalized in England, and signifying the winding up or catastrophe of a plot, the solution of any mystery, etc.

DEN'SITY, in physics, the quantity of matter contained in a body under a given bulk. If a body of equal bulk with another contains double the quantity of matter it is of double the density. Or if a body contain the same quantity of matter as another, but under a less bulk, its density is greater in proportion as its bulk is less than that of the other. Hence the density is directly proportional to the quantity of matter, and inversely proportional to the bulk or magnitude. The relative quantities of matter in bodies are known by their gravity or weight, and when a body, mass, or quantity of matter is spoken of, its weight or gravity is always understood, that being the proper measure of the density or quantity of matter. The weights of different bodies, of equal bulks, indicate their relative densities. The density of solids, fluids, and gases, as compared with that of water, is their Specific Gravity (which see). As for the density of the earth see Earth.

DENTAL FORMULA, an arrangement of symbols and numbers used to signify the number and kinds of teeth of a mammiferous animal. The dental formula of man is:

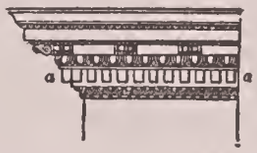
I. $\frac{2-2}{2-2}$, C. $\frac{1-1}{1-1}$, P.M. $\frac{2-2}{2-2}$, M. $\frac{3-3}{3-3}$ = 32,

which is read thus: Two incisors on each side of both jaws, one canine tooth on each side of both jaws, two præmolars on each side of both jaws, and three true molars on each side of both jaws, in all 32 teeth.

DENTA'RIA, coral-root, a genus of plants. There are about twenty species, natives of temporate countries. They are ornamental herbs, with creeping singularly toothed root-stocks, from which they received the names of coral-root and tooth-wort. The stem-leaves are opposite or in whorls of three, and the flowers are large and purple.

DEN'TIFRICE, a preparation for cleaning the teeth, of which there are various kinds in the form of tooth-powders, tooth-washes, or tooth-pastes. Cuttle-fish bone, finely-powdered chalk, and charcoal are common dentifrices. Rhatany, catechu, myrrh, and mastic are also often employed.

DEN'TILS, in arch., the little cubes resembling teeth, into which the square



a a, Dentils of the Corinthian cornice.

member in the bed-molding of an Ionic, Corinthian, or Composite cornice is divided.

DEN'TINE, the ivory tissue lying below the enamel and constituting the body of a tooth. It consists of an organic basis disposed in the form of extremely minute tubes and cells, and of earthy particles.

DENTISTRY, the art of curing, repairing, extracting, and treating the teeth. Dentistry was practiced in a crude way among the ancients, and modern dentistry is an almost wholly American art. The art is divided into mechanical dentistry and operative or surgical dentistry, the former having to do with the cleaning, filling, and replacing of teeth (except the transplanting of teeth, which would fall under the surgical division). The oldest dental school in the world is the Baltimore College of Dental Surgery, founded in 1839, the second oldest is the Ohio College of Dental Surgery founded in 1845. Almost all large universities and medical schools now have dental colleges. This increase in the educational facilities of dentistry has placed the modern dentist on a professional level as high as that of the medical doctor and has opened up a new art of surgery called stomatology, or the science of diseases of the mouth. By means of mechanical appliances the jaw can be lengthened and the expression of face entirely altered. Dentistry, in a somewhat high form, has been practiced for centuries by the chinese.

DENTITION. See Teeth, Teething.

DENUDA'TION, in geology, the act of washing away the surface of the earth by water, either in the form of constant currents or of occasional floods.

DENVER, a city and important railway center; capital of Colorado and of Arapahoe County; beautifully situated on South Platte river, 15 miles e. of the base of the Rocky Mountains; 5200 feet above the level of the sea. It commands a magnificent view of mountain scenery, including Pike's, Long's, and other noted peaks perpetually covered with snow. The streets are wide and shady, and the residences and public buildings, built largely of brick and yellow stone, are stately, handsome, and attractive. Denver is appropriately called "The Queen City of the Plains."

The city has over 150 churches, among them St. John's Cathedral (Protestant Episopal), noted for its stained glass window representing the crucifixion. The public school system is excellent. There are ten public and private libraries. The city is also the seat of Denver University, three medical colleges, and several private schools. The State capitol is 383 feet long and 313 feet wide. It stands on Capitol Hill, where is ob-

State capitol, Denver, Col.

tained the best view of the city. Other prominent buildings are the city-hall, the county court-house, and especially the U. States court-house and post-office. Denver has 143 miles of electric street railways, and is lighted by gas and electricity. It has an excellent system of water-works; water is brought from the mountains Seven railways center here, and there is a large and commodious union depot. All the eastern trunk lines maintain offices here. Denver has eleven parks, the largest, City Park, containing 340 acres. It is an important center for mining, agriculture, and stock-raising, the leading industries of the state. It has a branch U. States mint and many important manufactories.

The city was settled as a mining-camp in 1858–59. Its growth has been rapid and steady. Pop. 1909, 200,000.

DENVER, UNIVERSITY OF, founded at Denver, Colo., in 1864, by methodists. It has collegiate, medical, law, music, dental, and theological schools, an endowment of nearly $1,000,000, nearly 2,000 students, and 200 instructors.

DEODORI'ZERS, chemical substances which have the power of destroying fetid effluvia, as chlorine, chloride of lime, etc.

DEPART'MENT, the name given to the principal territorial divisions of France. At the time of the French revolution department replaced the old division into provinces, the change being voted in the constituent assembly in 1789. There are at present eighty-seven departments, each of which is subdivided into arrondissements.

DE PAUW UNIVERSITY, at Greencastle, Putnam county, Indiana, one of the chief institutions of learning maintained by the methodist church in America, constituted in 1837. It is excellently endowed, mainly by the liberality of the Hon. W. C. de Pauw, has a staff of 40 professors and teachers, and over 900 students.

DEPENDENT CHILDREN, children, who, although not defective, must be supported by others than their parents. In the United States there are numerous children's aid societies and homes for dependent children, and large sums of money are devoted to the proper rearing of such children. After a good training the children are placed in private families whose desirability has been specially investigated.

DEPEW, Chauncey Mitchell, an American lawyer, senator, and railroad president, born in New York in 1834. Since 1866 he has been identified with the Vanderbilt railroads and in 1899 was elected to the United States senate.

DEPO'NENT, (1) in grammar, a verb passive in form but active or neuter in signification. (2) In law, a person who makes an affidavit, or one who gives his testimony in a court of justice; a witness upon oath.

DEPOS'IT, in law, something given or entrusted to another as security for the performance of a contract, as a sum of money or a deed. In commerce, a deposit is generally either money received by banking or commercial companies with a view to employ it in their business, or documents, bonds, etc., lodged in security for loans. In the first case interest is usually paid to the depositor. The receipt given by the banker for money deposited with him is called a deposit receipt.

DEPOSIT, in geology, a layer of matter formed by the settling down of mud, gravel, stones, detritus, organic remains, etc., which had been held in suspension in water.

DEPOSITION, in law, the testimony given in court by a witness upon oath. It is also used to signify the attested written testimony of a witness by way of answer to interrogatories. Depositions are frequently taken conditionally, or de bene esse, as it is called; for instance, when the parties are sick, aged, or going abroad, depositions are taken, to be read in court in case of their death or departure before the trial comes on.

DEPOT (dā'pō or dep'ō), a French word in general use as a term for a place where goods are received and stored; hence, in military matters, a magazine where arms, ammunition, etc., are kept. The term is now usually applied to those companies of a regiment which remain at home when the rest are away on foreign service. In America it is the common term for a railway-station.

DEPRIVATION, the removing of a clergyman from his benefice on account of heresy, misconduct, etc. It entails, of course, loss of all emoluments, but not the loss of clerical character.

DE PROFUNDIS, in the liturgy of the Roman Catholic Church, one of the seven penitential psalms, the 130th of the Psalms of David, which in the vulgate begins with these words, signifying "Out of the depths." It is sung when the bodies of the dead are committed to the grave.

DEPTFORD (det'ford), a parl. and mun. borough, England, in the counties of Kent and Surrey, on the right bank of the Thames, forming now part of London. It has some manufactures of pottery, chemicals, soap, etc. Pop. 110,513.

DEP'UTY, one who exercises an office as representing another.—Chamber of Deputies, the lower of the two legislative chambers in France and in Italy, elected by popular suffrage, and corresponding in some respects to the House of Commons in Britain. See France, Italy.

DE QUINCEY, Thomas, author of Confessions of an English Opium Eater was born at Greenhay, near Manchester, on 15th August, 1785. He died at Edinburgh December 8, 1859. His writings, nearly all contributions to magazines, are distinguished by power of expression, subtle thought, and an encyclopædic abundance of curious information.

DERA GHAZI KHAN, a district and town in the Punjab, Hindustan. The former, which is in Derajat division, has an area of 5606 sq. miles and a population of 404,031. The town has a population of 23,731, half Hindus and half Mohammedans. It has extensive manufactures of silk, cotton, and coarse cutlery.

DERAJAT (-jāt'), a commissionership of Hindustan, in the west of the Punjab, occupying part of the valley of the Indus. It is well watered and fertile, and contains numerous towns and villages. Pop. 1,643,603, mostly Mohammedans.

DERBY, a municipal, parl., and county borough in England, capital of Derbyshire, 115 miles n.n.w. London. Derby is one of the oldest towns in the kingdom, and is supposed to owe its origin to a Roman station, Derventio. Under the Danes it took the name of Deoraby. Richardson, the novelist and Herbert Spencer were natives. Pop. 105,785.—The county of Derby in the center of the kingdom, is about 55 miles long and from 15 to 30 broad; area, 658,624 acres, or 1029 square miles, five-sixths being arable or in permanent pasture. The principal rivers are the Derwent, the Trent, the Wye, the Erwash, the Dove, and the Rother. Oats and turnips are important crops, and dairy-husbandry is carried on to a large extent. Coal is abundant in various parts of the county, iron ore is also plentiful, and lead, gypsum, zinc, fluor-spar, and other minerals are obtained. The manufactures are very considerable, especially of silk, cotton, and lace, machinery, and agricultural implements. Pop. 620,196.

DERBY, Edward Geoffrey Smith

Edward, 14th Earl of Derby.

Stanley, fourteenth Earl of, an English statesman, born in Knowsley Park, Lancashire, March 29, 1799; died there

Oct. 23, 1869. In 1820 he was returned to the House of Commons as member for Stockbridge, and in 1830 became chief secretary for Ireland, in Lord Grey's government. In 1841 he became colonial secretary under Sir Robert Peel, but resigned on Peel's motion for repeal of the corn-laws. In 1851 and 1858 he formed ministries which held office only for a short period; and again in 1866, when his administration signalized itself by the reform of the government in India, the conduct of the Abyssinian war, and the passing of a bill for electoral reform (1867).

DERBY-DAY, the great annual London holiday, on which the horse-race for the stakes instituted by Lord Derby in 1780 is run. It always falls on a Wednesday, being the second day of the grand race meeting which takes place in the week after Trinity Sunday. The race is run on Epsom Downs, an extensive plain in the neighborhood of London. The entry-money for each subscriber is fifty guineas, and the stakes are run for by colts of three years. In the first year of the Derby there were only thirty-six entries, but now they are so numerous that the value of the stakes reaches several thousand pounds. The Epsom races are the most popular of the English horse-races. The Ascot races are patronized by royalty, the world of fashion is to be seen at Goodwood, but on Epsom Downs, on the Derby-day, are assembled all classes, high and low.

DER'ELICT, a vessel or anything relinquished or abandoned at sea, but most commonly applied to a ship abandoned by the crew and left floating about.

DERIVATION. See Etymology.

DERMA, Dermis, the true skin, or under layer of the skin, as distinguished from the cuticle, epidermis, or scarf-skin.

DERMATOLOGY, the branch of medicine which treats of the skin and its diseases.

DER'RICK, a lifting apparatus, consisting of a single post or pole, supported by stays and guys, to which a boom with a pulley or pulleys is attached, used in loading and unloading vessels, etc. Floating derricks of the strongest construction, with an immense boom and numerous blocks, are also used.

DERRICK-CRANE, a kind of crane combining the advantages of the common derrick and those of the ordinary crane. The jib of this crane is fitted with a joint at the foot, and has a chain instead of a tension-bar attached to it at the top, so that the inclination, and consequently the sweep, of the crane can be altered at pleasure.

DERRY. See Londonderry.

DER'VISH, a Mohammedan devotee, distinguished by austerity of life and the observance of strict forms. There are many different orders of them. Some live in monasteries, others lead an itinerant life, others devote themselves to menial or arduous occupations.

DESCARTES (dā-kärt), René, a great French philosopher and mathematician, with whom the modern or new philosophy is often considered as commencing, was born March 31, 1596, at La Haye, in Touraine. Descartes, seeing the errors and inconsistencies in which other philosophers had involved themselves, determined to build up a system anew for himself, divesting himself first of all the beliefs he had acquired by education or otherwise, and resolving to accept as true only what could stand the test of

Traveling dervish of Khorasan.

reason. Proceeding in this way he found that there was one thing that he could not doubt or divest himself of the belief of and that was the existence of himself as a thinking being, and this ultimate certainty he expressed in the celebrated phrase "I think, therefore I am." Here, then, he believed he had found the test of truth. Starting from this point Descartes found the same kind of certainty in such propositions as these: that the thinking being or soul differs from the body (whose existence consists in space and extension) by its simplicity and immateriality and by the freedom that pertains to it; that every perception of the soul is not distinct; that it is so far an imperfect finite being; that this imperfection of its own leads it to the idea of an absolutely perfect being; and from this last idea he deduces all further knowledge of the truth. Descartes also contributed greatly to the advancement of mathematics and physics. The higher departments of geometry were greatly extended by him. His works effected a great revolution in the principles and methods of philosophizing. In 1647 the French court granted him a pension and two years later, on the invitation of Christina of Sweden, he went to Stockholm, where he died Feb. 11, 1650.

DESCENDANTS. See Descent.

DESCENT', in law, is the transmission of the right and title to lands to the heir, on the decease of the proprietor, by the mere operation of law. The rule determining to whom an estate belongs, on the decease of the proprietor, is that of consanguinity, or relationship by blood, though with some exceptions, as in the case of the portion, or the use of a portion, of a man's property given by the law to his widow. The rules of descent, designating what relations shall inherit, and their respective shares, will be determined by the genius and policy of the government and institutions. Hence the practice of entailments in the feudal system. And wherever the government is founded in family privileges, or very intimately connected with them, as is the case in all governments where the hereditarily aristocratical part of the community have a great preponderance, the sustaining of families will very probably be a characteristic feature in the code of laws. Thus, in Britain, all the lands of the father, unless otherwise directed by will go to the eldest son. In the U. States this distinction in favor of the eldest son has been abolished, and the laws are founded upon the principle of equal distribution both of real and personal estate among heirs of the nearest surviving degree. Kindred in blood are divided into three general classes, viz. 1, descendants; 2, ancestors; 3, collateral relatives, that is, those who have descended from the same common ancestor. The civil law computes the degrees by counting the generations up to the common ancestor, as father, grandfather, great-grandfather; or mother, grandmother, great-grandmother; and from him or her down to the collateral relative, as brother, cousin, etc., making the degree of relationship the sum of these two series of generations. Every person has two sets of ancestors, the paternal and maternal, and therefore two sets of collateral relatives. There is also a distinction of collateral kindred, into those of the whole blood and those of the half blood.

DES'ERET. See Utah.

DES'ERT, a term more particularly applied to vast barren plains such as are found in Asia and Africa, but which may also be used to designate any solitude or uninhabited place whether barren or not. See Sahara and Gobi.

DESERT'ER, a soldier or sailor who quits the service without leave. Deserters are tried by court-martial, which may inflict death as the extreme punishment, or a less severe punishment, according to the circumstances of the case.

DESERTION, by husband or wife, without due cause, is ground for a judicial separation. A wife may obtain an order to protect any money or property she may have acquired since desertion, against her husband or his creditors.

DESICCATION, a process of dispelling moisture by the use of air, heat, or chemical agents such as chloride of calcium, quicklime, oil of vitriol, and fused carbonate of potash.—Desiccation cracks, in geology, are the fissures caused in clayey beds by the sun's heat, and seen in various rock strata.

DESIGN, the art of creating ornamental devices of any kind, or for any purpose. Design is one of the most ancient of arts and has been carried to its highest complexity and development in the orient. Schools of design were originated in France during the reign of Louis XIV. and were later introduced into England and other countries, and most recently in America. Principles of design are taught in these schools, covering the designing of patterns for laces, rugs, carpets, wall paper, glassware, in short, everything to which an ornamental design can add beauty.

DES MOINES (dė moin), capital of the state of Iowa and of Polk county, on the Des Moines River, about 350 miles west of Chicago. Among its chief buildings are the state house, the state arsenal, colleges, opera-houses, etc. There are

coal-mines in the vicinity, and the manufactures and other industries are varied and increasing. Pop. 1909, 80,000.

DES MOINES, the largest river in the state of Iowa, rises in the s.w. of Minnesota and flows in a south-easterly

State capitol, Des Moines, Ia.

direction till it falls into the Mississippi about 4 miles below Keokuk, after a course of 300 miles.

DESMOL'OGY, that branch of anatomy which treats of the ligaments and sinews.

DESMOULINS (dā-mö-laṇ), Benoît Camille, born in 1760 or 1762, was conspicuous during the first period of the French revolution. He was among the most notable of the pamphleteers and orators who urged the multitude forward in the path of revolution. In 1793 he gave his vote for the death of the king. Having become closely connected with Danton and the party of opposition to Robespierre, and inveighing against the reign of blood and terror, he was arrested on the order of the latter on 30th March, 1794, tried on the 2d April, and executed on the 5th. He met his fate in an agony of despair.

DE SOTO, Hernando, a Spanish explorer and discoverer of the Mississippi, born about 1496, died in 1542. He accompanied expeditions to the New World under Davila and Pizarro, and played a distinguished part in the conquest of Peru. In 1536 he led an expedition to Florida, whence after many difficulties he penetrated to the Mississippi, where he was attacked with fever and died.—The name De Soto has been given to a county in the n.w. of Mississippi, and to several places in the U. States.

DES'POT, originally a master, a lord; at a later period it became an honorary title which the Greek emperors gave to their sons and sons-in-law when governors of provinces. At present despot means an absolute ruler, as the Emperor of Russia, and in a narrower sense a tyrannous one.

DESSAU (des'ou), a town in Germany, capital of the duchy of Anhalt. The manufactures consist of woolens, woolen yarn, carpets, machinery, tobacco, etc. The ducal palace has a picture-gallery and interesting relics and antiquities. Pop. 50,677.

DETACH'MENT, a body of troops selected from the main army for some special service.

DET'ONATING POWDERS, certain chemical compounds, which, on being exposed to heat or suddenly struck, explode with a loud report, owing to one or more of the constituent parts suddenly assuming the gaseous state. The chloride, and iodide of nitrogen are very powerful detonating substances. The compounds of ammonia with silver and gold, fulminate of silver and of mercury, detonate by slight friction by means of heat, electricity, or sulphuric acid.

DETROIT, the principal city of Michigan, a port of entry and county-seat of Wayne county, situated on the Detroit River, 285 miles northeast of Chicago, connecting Lakes Erie and St. Clair. Pop. 1909, 400,000.

The city has an area of 29 sq. miles, and is finely situated on ground rising gradually from the river. It has broad, clean, well shaded and paved streets. Most of the streets cross at right angles, but these are intersected by several broad avenues, radiating from the Grand Circus, a semicircular park of five and a half acres in the heart of the city. Woodward Avenue extends through this, and divides the city into nearly equal portions.

Detroit has a superb park system the central feature of which is Belle Isle, an island park of 707 acres. The city contains a number of institutions of higher education, an excellent public school system, and numerous hospitals and charitable institutions. In trade it ranks among the Canada export cities of the United States and it is also a very large manufacturing center. It was settled by the French in 1810.

DETROIT RIVER, or **STRAIT OF ST. CLAIR,** a river or strait of North America, which runs from Lake St. Clair to Lake Erie. It is 28 miles long, and of sufficient depth for the navigation of large vessels. It is about ¾ mile wide opposite Detroit and enlarges as it descends.

DEUTERON'OMY, the last of the books of the Pentateuch, so called from its consisting in part of a restatement of the law as already given in Exodus, Leviticus, and Numbers, and containing also, in addition to special commands and admonitions not previously given, an account of the death of Moses. See Pentateuch.

DEVIATION OF THE COMPASS, the deviation of a ship's compass from the true magnetic meridian, caused by the near presence of iron. In iron ships the amount of deviation depends upon the direction, with regard to the magnetic meridian, in which the ship lay when being built. It is least when the ship has been built with her head south. Armor-plated ships should be plated with their head in a different direction from that in which they lay when built. The mode now generally employed to correct deviation is by introducing on board ship masses of iron and magnets to exactly neutralize the action of the ship's magnetism. Compasses are sometimes carried on masts in iron vessels as a means of removing them from the disturbing influence of the iron of the hull. In this position they serve as standards of comparison for the binnacle compass. Wooden ships are also affected, though in a far less degree, by the direction in which they lie when building.

DEVICE', a name common to all figures, ciphers, characters, rebuses, mottoes, etc., which are adopted by a person or a family by way of badge or distinctive emblem, often a representation of some natural body, with a motto or sentence applied in a figurative sense.

DEVIL, in theology, an evil spirit or being; specifically the evil one, represented in Scripture as the traducer, father of lies, etc. Most of the old religions of the East acknowledge a host of devils. The doctrine of Zoroaster, who adopted an evil principle called Ahriman, opposed to the good principle and served by several orders of inferior spirits, spread the belief in such spirits among the people. The Greek mythology did not distinguish with the same precision between good and bad spirits. With the Mohammedans Eblis, or the devil, was an archangel whom God employed to destroy a pre-Adamite race of jinns, or genii, and who was so filled with pride at his victory that he refused to obey God. The Satan of the New Testament is also a rebel against God. He uses his intellect to entangle men in sin and to obtain power over them. But he is not an independent self-existent principle like the evil principle of Zoroaster, but a creature subject to omnipotent control. The doctrine of Scripture on this subject soon became blended with numerous fictions of human imagination, with the various superstitions of different countries, and the mythology of the pagans. The excited imaginations of hermits in their lonely retreats, sunk as they were in ignorance and unable to account for natural appearances, frequently led them to suppose Satan visibly present; and innumerable stories were told of his appearance, and his attributes—the horns, the tail, cloven foot, etc.—distinctly described. In consequence of the cures which Christ and his apostles performed on the possessed, the early church believed in a power connected with the consecration of priests to drive out evil spirits. (See Exorcism.) The belief in evil spirits, witches, etc., was in the 17th century so common that they became the objects of judicial process. With the progress of the natural sciences, however, in the 18th century many wonderful phenonema became explained, and less was heard of witchcraft.

DEVIL, the machine through which cotton or wool is first passed to prepare it for the carding-machines; a teasing-machine.

DEVIL-FISH, the popular name of various fishes, one of them being the angler (which see). Among others the name is given to several large species of ray occasionally captured on the Atlantic and Pacific coasts of America, and much dreaded by divers, whom they are said to devour after enveloping them in their vast wings. During gales of wind or from strong currents these immense fish are driven into shoal water, and being unable to extricate themselves, fall an easy prey to the vigilance of the fishermen, who obtain considerable quantities of oil from their livers.

DEVIL'S PUNCH-BOWL, a small lake of Ireland, near the Lakes of Killarney, between 2,000 and 3,000 feet above the sea, supposed to be the crater of an ancient volcano.

DEVIL-WORSHIP, the worship paid to the devil, an evil spirit, a malignant deity, or the personified evil principle in nature, by many of the primitive tribes of Asia, Africa, and America, under the assumption that the good deity does not trouble himself about the world; or that the powers of evil are as mighty as the power of good, and have in consequence to be bribed and reconciled. There is a sect called devil-worshipers inhabiting Turkish and Russian Armenia and the valley of the Tigris, who pay respect to the devil, to Christ, and to Allah or the supreme being, and also worship the sun.

DE VINNE, (dē-vin'-ne), Theodore Low, an American printer, born in Connecticut in 1828. He is the founder of the Typothetæ Society and has done much for the improvement of typographical art in the United States.

DEVON, Devonshire, a maritime county in the s. w. of England, its northern coast being on the Bristol Channel and its southern on the English Channel; area, 1,655,208 acres, or 2586 square miles, the county being the third largest of England. Tin, lead, iron, copper, manganese, granite, and the clay used by potters and pipe-makers are the chief mineral products. The geological formation of the Old Red Sandstone is so largely developed that the term Devonian has to some extent become its synonym. Agriculture is in a somewhat backward state, owing, probably, to the general preference given to dairy husbandry, for which the extent and richness of its grass lands make the county most suitable. Wheat, barley, beans, pease, and potatoes are the principal crops. Pop. 660,444.

DEVO'NIAN SYSTEM, in geology, a name originally given to rocks of Devonshire and Cornwall, intermediate between the silurian and carboniferous strata, and consisting of sandstones of different colors, calcareous slates and limestones, etc. They are divided into lower, middle, and upper groups, all containing fossils, but the middle most abounding in them, including corals, crinoids, crustaceans, mollusca (especially brachiopods), and cephalopods. Devonian rocks occupy a large area in Central Europe, as well as in the United States, Eastern Canada, and Nova Scotia. The term has been often used as equivalent to Old Red Sandstone.

DEV'ONPORT, a municipal, parl., and county borough and port of England, county of Devon, contiguous to Plymouth. It is the seat of one of the royal dockyards, and an important naval and military station. Pop. 69,674.

DEVONSHIRE. See Devon.

DEVONSHIRE, Duke of. See Cavendish.

DEW is a deposition of water from the atmosphere upon the surface of the earth in the form of minute globules. During the day the earth both absorbs and emits heat, but after sunset its supply of warmth is cut off, while it still continues to radiate heat into the surrounding space. Grass, flowers, and foliage being good radiators, lose after sunset the heat which has previously been absorbed by them, without receiving any in return, and their temperature consequently falls considerably below that of the atmosphere. From the proximity of these cold substances the particles of vapor in the adjoining air are condensed and deposited upon their surfaces in the form of dew, or of hoar-frost where the temperature of the earth is below 32°. When the sky is clouded the heat abstracted from the earth's surface by radiation is restored by the clouds, which, being good radiators, send back an equal amount of heat to what they receive; and a balance of temperature being thus maintained between the earth and the surrounding atmosphere, no dew is formed. The deposition of dew is likewise prevented by wind, which carries away the particles of air before the vapor contained in them has been condensed. Horizontal surfaces, and those which are exposed to a wide expanse of sky, receive a greater supply of dew than sheltered or oblique surfaces, where circumstances diminish the amount of radiation. The radiation from the earth's surface is one of those happy provisions for the necessities of living beings with which nature everywhere abounds. The heavy dews which fall in tropical regions are in the highest degree beneficial to vegetation, which, but for this supply of moisture, would, in countries where scarcely any rain falls for months, be soon scorched and withered. But after the high temperature of the day the ground radiates under these clear skies with great rapidity, the surface is quickly cooled, and the watery vapor, which, from the great daily evaporation, exists in large quantities in the atmosphere, is deposited abundantly. This deposition is more plentiful also on plants, from their greater radiating power; while on hard, bare ground and stones, where it is less wanted, it is comparatively trifling. In cold climates the earth, being cold and sufficiently moist, requires little dew; accordingly the clouds, which are so common in damp and chilly regions, prevent the radiation of heat; the surface is thus preserved warm, and the deposition of dew is, in a great measure, prevented.

DEWAS, a native state of Central India consisting of two combined states with two chiefs. Total pop. 152,073. Dewás, the chief town, has a pop. of 15,100.

DE WET, Christian, a Boer soldier born in South Africa in 1853. He fought with distinction in the Anglo-Boer war of 1880–1 and later in that of 1899–1902. He finally submitted to the English.

DEWEY, George, an American admiral, born in Vermont in 1837. He served under Farragut during the civil war, and at the opening of the Spanish-American he was the commodore commanding the oriental station. Dewey at once proceeded to Manila, destroyed the Spanish ships there and took possession of Manila. On his return home in 1899 he was given a popular ovation and promoted to the rank of admiral, a rank which Farragut and Porter only had won before him.

DEWEY, Melvil, an American librarian born in New York state in 1851. His principal work is the invention of a decimal system of cataloguing.

George Dewey.

DE WITT, Jan, Grand-pensionary of Holland, celebrated as a statesman and for his tragical end, was born in 1625 or 1632. He became the leader of the political party opposed to the Prince of Orange, and in 1652, two years after the death of William II., was made grand-pensionary. In 1665 the war with England was renewed and conducted by De Witt with great ability till its termination in 1665. In 1672 Louis XIV. invaded the Spanish Netherlands and involved Holland in war. De Witt's popularity, already on the decline, suffered still further in the troubles thus occasioned, and he felt it necessary to resign his office of grand-pensionary. At this time his brother Cornelius, who had been tried and put to torture for conspiring against the life of the young Prince of Orange, lay in prison. Jan de Witt went to visit him, when a tumult suddenly arose among the people, and both brothers were murdered, Aug. 20, 1672. De Witt was a man of high character, simple and modest in all his relations.

DEW-POINT, the temperature at which condensation of the vapor in the air takes place. When the temperature of the air has been reduced by radiation to the dew-point, dew is deposited and an amount of heat set free which raises the temperature of the air. Thus the dew-point will indicate what the minimum temperature of the night is likely to be, a knowledge of which is useful to the horticulturist.

DEY, a title formerly assumed by the rulers (under the Turkish Sultan) of Algiers, Tripoli, and Tunis.

DHAR (dhár), a small native state in Central India, with an area of about 1740 sq. miles. The soil is fertile, and yields wheat, rice, opium, etc. Pop. 169,474.

DHARWAR, the chief town of Dhárwár district, in the Bombay presidency, Hindustan. Pop. 32,841. The Dhárwár district has an area of 4535 sq. miles; pop. 1,051,314.

DHOLPUR, native state of Central India, Rajputána; area, 1200 square miles; pop. 279,657. The capital is also called Dholpur. Pop. 15,833.

DHOW (dou), an Arab sea-going vessel, ranging from a comparatively small size up to 250 tons burden, with one mast and a large square sail. It is

used for merchandise and is often employed in carrying slaves from the east coast of Africa to Arabia.

Slave dhow, east coast of Africa.

DIABE'TES, a disease of which the most remarkable symptoms are: a great increase in the quantity of urine, a voracious appetite, a stoppage of the cutaneous perspiration, thirst, emaciation, and great muscular debility. In true diabetes the composition of the urine is also greatly affected, an abundance of saccharine matter (diabetic sugar) being found in it. This disease usually attacks persons of a debilitated constitution and often without any obvious cause. With respect to treatment a diet should be employed of which farinaceous or saccharine matter (starch and sugar) forms no part, ordinary bread or biscuits, rice, arrow-root, pastry, and fruits being accordingly forbidden, though almost any kind of animal food, including eggs, cheese, butter, cream, etc., as also various vegetables may be eaten. Tea, coffee, dry wines, spirits, and bitter ale may be drunk. Milk should be taken only sparingly. The disease is essentially a chronic one, though death may occur with great rapidity. Diseases of the lungs are liable to attack a diabetic person.

DIABETIC SUGAR, the sweet principle of diabetic urine. It is identical with starch-sugar, grape-sugar, etc. It is a constant though trifling constituent of healthy urine, but in diabetes amounts to 8 or 10 per cent, and in some cases more.

DIACOUS'TICS, the science or doctrine of sounds as they are refracted by passing through different mediums.

DI'ADEM, an ancient ornament of royalty. It was originally a head-band or fillet made of silk, linen, or wool, worn round the temples and forehead, the ends being tied behind and let fall on the neck, as seen in old representations of the diadem of the Indian Bacchus. Latterly it was usually set with pearls and other precious stones. The term is also used as equivalent to crown or coronet.

DIAGNO'SIS, in medicine, the discrimination of diseases by their distinctive marks or symptoms; the discovery of the true nature and seat of a disease.

DIAG'ONAL, in geometry, a straight line drawn between the opposite angles of a quadrilateral figure.

DIAG'ONAL SCALE, a scale which consists of a set of parallel lines drawn on a ruler, with lines crossing them at right angles and at equal distances. One of these equal divisions, namely, that at the extremity of the ruler, is subdivided into a number of equal parts, and lines are drawn through the points of division obliquely across the parallels.

Diagonal scale.

With the help of the compasses such a scale facilitates the laying down of lines of any required length to the 200th part of an inch.

DI'AGRAM, a figure or geometrical delineation applied to the illustration or solution of geometrical problems, or any illustrative figure in which outlines are chiefly presented, and the details more or less omitted.

DIAL, or **SUN-DIAL,** an instrument for showing the hour of the day from the shadow thrown while the sun is shining by a stile or gnomon upon a graduated surface. This instrument has been known from the earliest times among Egyptians, Chaldeans, and Hebrews. From those eastern nations it came to the Greeks. It was introduced into Rome during the first Punic war. Dials are of various constructions, horizontal, inclined, or upright, the principle in every case being to show the sun's distance from the meridian by means of the shadow cast by the stile or gnomon. The stile is made parallel with the earth's axis, and may be considered as coinciding with the axis of the diurnal rotation. Consequently as the sun moves westward the shadow of the stile moves round in the opposite direction, falling on the meridian lines so marked as to represent the hours of the day. The dial of course gives solar time, which, except on four days of the year, is slightly different from that of a well-regulated clock. Dials are now rather articles of curiosity or ornament than of use.

DI'ALECT, the language of a part of a country, or a distant colony, deviating either in its grammar, vocabulary, or pronunciation, from the language of that part of the common country whose idiom has been adopted as the literary language, and the medium of intercourse between well-educated people.

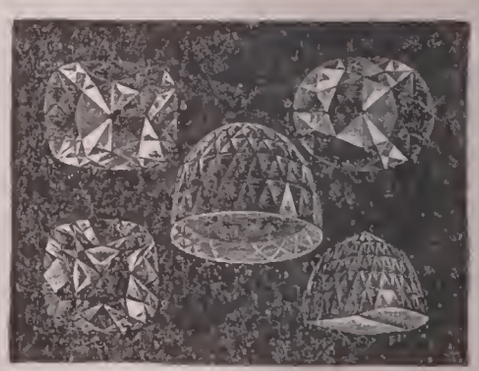
DIALEC'TICS, the old name of logic, or the art of reasoning, but used in Kant's philosophy to mean the logic of appearance, or that logic which treats of inevitable tendencies toward error and illusion in the very nature of reason.

DI'ALOGUE, a conversation or discourse between two or more persons. The word is used more particularly for a formal conversation in theatrical performances, and for a written conversation or composition, in which two or more persons carry on a discourse. This form was much in favor among the ancient philosophers as a medium for expressing their thoughts on subjects. The Dialogues of Plato are the finest example. Many of the great French and Italian writers have used this form. Landor's Imaginary Conversations is the best production of this kind in English.

DIAMAGNET'IC, a term applied to substances which, when under the influence of magnetism and freely suspended, take a position at right angles to the magnetic meridian, that is, point east and west. From the experiments of Faraday it appears that all matter is subject to the magnetic force as universally as it is to the gravitating force, arranging itself into two great divisions, the paramagnetic and diamagnetic. Among the former are iron, nickel, cobalt, platinum, palladium, titanium, and a few other substances; and among the latter are bismuth, antimony, cadmium, copper, gold, lead, mercury, silver, tin, zinc, and most solid, liquid, and gaseous substances. When a paramagnetic substance is suspended freely between the poles of a powerful horseshoe magnet it points in a line from one pole to the other, which Faraday terms the axial line. On the other hand, when a diamagnetic substance is suspended in the same manner it is repelled alike by both poles, and assumes an equatorial direction, or a direction at right angles to the axial line.

DIAM'ETER, the straight line drawn through the center of a circle, and touching the two opposite points of the circumference. It thus divides the circle into two equal parts, and is the greatest chord. The length of the diameter is to the length of the circumference of the circle as 1 to 3·14159265..., the latter number being an interminable decimal.

DIAMOND, the hardest and most valuable of gems and the purest form in which the element carbon is found. A diamond and a piece of charcoal are the same thing, that is, both are carbon, only that the molecules are differently arranged. Diamonds can be made artificially, but the expense attaching to the work is too great to give the process a commercial value. Previous to the discovery of the Brazilian mines Borneo and India were chief sources of supply. The South African mines, it is believed, now absolutely control the diamond market of the world.



Five of the great diamonds of the world. The "Great Mogul" in the middle; left hand upper corner, "Star of the South"; right hand, "Koh-i-nûr"; left hand lower, "Regent"; right hand, "Orloff." About one-half actual size.

The most valuable gems, among which there are some exceeding 100 carats in weight, are generally owned by royal families or are treasured by governments as state jewels. One

of the largest is the Orloff, owned by the Czar of Russia, which weighs 195 carats, and is cut in rose form. Its origin is doubtful; according to one account, it was stolen from a Brahman temple in India, while another indicates that it was owned by Nadir Shah of Persia, and came after his death into the hands of an Armenian merchant. In 1772 it was purchased by the Empress Catharine II., at a price said to have been $450,000, besides an annuity of $4,000 and a Russian title. The Koh-i-nur, weighing 102¾ carats, and owned by the royal family of England, was found, according to legend, in India long before the Christian Era. After having been handed down through a long line of Indian princes, it was seized during the British invasion of the Punjab, and carried to England. The stone is said to have weighed originally 794 carats, having been reduced to its present size by repeated cutting. The Regent or Pitt diamond, in the Louvre in Paris, weighs 136 carats, and is valued at $2,500,000. It is perhaps the finest of large brilliants. The Hope diamond, weighing 44½ carats, is a beautiful blue stone, valued at $125,000. A light green diamond of 48½ carats, in the Green Vault at Dresden, and a red diamond of 10 carats among the crown jewels of Russia, are unique specimens. Among the most valuable stones found in recent times are the Victoria, weighing 180 carats, which was purchased by the Nizam of Hyderabad; the De Beers, weighing 225 carats; and the Tiffany, weighing 125 carats.

DIAMOND NECKLACE, an affair of some note in French history immediately preceding the Revolution.

DIAN'A, in mythology, an ancient Italian goddess whom the Romans latterly identified with the Greek Artĕmis, with whom she had various attributes in common, being the virgin

Diana—Antique statue in the Louvre.

goddess of the moon and of the chase, and having as attributes the crescent moon, bow, arrows, and quiver. The name is a feminine form of Janus. She seems to have been originally the patron divinity of the Sabines and Latins. She was worshiped especially by women as presiding over births, no man being allowed to enter her temple. See Artemis.

DIANA OF POITIERS, Duchess of Valentinois, born in 1499. She was the mistress of King Henry II. of France, and descended from the noble family of Poitiers, in Dauphiny. At an early age she married the Grand-seneschal of Normandy, Louis de Brezé, became a widow at thirty-one, and some time after the mistress of the young Duke of Orleans. On his accession to the throne, in 1547, as Henry II., Diana continued to exercise an absolute empire over him till his death in 1559. After that event she retired to her castle of Anet, where she died in 1566.

DIAPA'SON, in music, the concord of the first and last notes of an octave. The word is also used for the most important foundation-stops of an organ. They are of several kinds, as open diapason, stopped diapason, double diapason. The French use the term as equivalent to pitch in music.

DI'APER, a kind of textile fabric much used for towels and napkins, and formed either of linen or cotton, or a mixture of the two, upon the surface of which a flowered or figured pattern is produced by a peculiar mode of twilling.

DIAPHORET'ICS are agents used in medical practice for producing a greater degree of perspiration than is natural, but less than in sweating. The Turkish bath and a large part of hydropathic treatment, diluent drinks, etc., are employed for this purpose. Diaphoretics increase only the insensible perspiration, while sudorifics excite the sensible discharge called sweat.

DIAPHRAGM (dī'a-fram), in anatomy, a muscular membrane placed transversely in the trunk, and dividing the chest from the abdominal cavity. In its natural situation the diaphragm is convex on the upper side and concave on its lower, but when the lungs are filled with air it becomes almost flat. It is the principal agent in respiration, particularly in inspiration. A complete diaphragm is found only in mammalia.

DIARRHŒ'A, a very common disease, which consists in an increased discharge from the alimentary canal, the evacuations being but little affected, except in their assuming a more liquid consistence. They are generally preceded or accompanied by flatulence and a griping pain in the bowels, and frequently by sickness. Diarrhœa is often produced by indigestible food, repletion of the stomach, cold applied to the surface of the body, impressions on the nervous system. It is often also a symptom of some other disease. In its simple form diarrhœa is not difficult of cure, mild purgatives given in small doses and accompanied by quantities of mild diluents being frequently successful. Castor-oil, rhubarb, magnesia are the most generally applicable. The food should be of the least stimulating kind.

DIARY, a daily record of any kind, customarily kept in a blank book with forms printed for this purpose. The diary form of narration is often made use of by novelists to relieve the monotony of an otherwise tiresome narration.

DIATH'ESIS, in medicine, a certain general habit or constitution of body as predisposing to certain diseases.

DIAZ (dē-as), Porfirio, a Mexican statesman and soldier, president of Mexico, born at Oaxaca in 1830. As a youth he entered the army, led a battalion against Santa Anna, was a member of congress in 1861, and took Puebla in 1867 after the evacuation of the French. In 1867 he became a candidate for the presidency but was defeated. He revolted successfully against the government and in 1877 was elected president, a post he has held almost continuously since that time. He has ruled Mexico with a hand of iron, but the people like him, and he has been very successful in bringing foreign capital into the country.

DICE, cubical pieces of bone or ivory, marked with dots on each of their six faces, from one to six, according to the number of faces. They are shaken in a small box and then thrown on the table. Dice are often loaded or falsified in some way so as to make the high or low side turn down. Dice are very ancient, being well known among the Egyptians and Greeks.

DICHROSCOPE (dī'kro-skōp), an optical instrument, usually consisting of an achromatized double-image prism of Iceland-spar, fixed in a brass tube, which has a small square hole at one end and a convex lens at the other, of such a power as to give a sharp image of the square hole. On looking through the instrument the square hole appears double, and if a dichroic crystal is placed in front of it the two images will appear of different colors.

DICKENS, Charles, one of the greatest English novelists, was born February 7th, 1812, at Landport, Portsmouth, died 1870. Having perfected himself in shorthand, however, he became a

Charles Dickens

newspaper critic and reporter, was engaged on the Mirror of Parliament and the True Sun, and in 1835 on the Morning Chronicle. For some time previously he had been contributing humorous pieces to the Monthly Magazine; but at length, in 1835, appeared in the Sketches by Boz which brought Dickens

into fame. In 1836 he was engaged to prepare the letterpress for a series of comic sketches on sporting subjects, the result being the immortal Pickwick Papers. The great characteristics of Dickens' genius were now fully apparent, and his fame rose at once to the highest point it was possible for a writer of fiction to reach. He was buried in Westminster Abbey. Dickens' work as a novelist is firmly based upon a wide and keen observation of men. It is true that most of his characters suffer from being created to exhibit little more than one trait or quality alone, and thus receive an air of grotesqueness and exaggeration which approaches caricature. But the single trait of quality which they embody is so truly conceived, and exhibited with such vitality and humor, as to place Dickens, in spite of all that is grotesque and overstrained in his work, among the great artists.

DICKINSON COLLEGE, founded in 1783 at Carlisle, Pa., and named for John Dickinson. It has a preparatory, a collegiate, and a law school, about 500 students, property worth $1,000,000, and a library of 30,000 volumes.

DICKINSON, John, an American political writer, known as "the penman of the revolution." He was born in Maryland in 1732 and died in 1808. Dickinson studied law in London and early allied himself with the revolutionary movement. He was a member of several of the early and later conventions, but was chiefly distinguished for his state papers and pamphlets. He refused to sign the declaration of independence, which caused his influence to wane.

DICTA'TOR, an extraordinary magistrate of the Roman Republic, first instituted B.C. 501. The power of naming a dictator when an emergency arose requiring a concentration of the powers of the state in a single superior officer, was vested by a resolution of the senate in one of the consuls. The dictatorship was limited to six months, and the person who held it could not go out of Italy. This rule was laid aside during the first Punic war. The dictator was also forbidden to appear in Rome on horseback without the permission of the people, and he had no control over the public funds without the permission of the senate. He had the power of life and death, and could punish without appeal to the senate or people. All the other magistrates were under his orders.

DICTIONARY, a book containing the words, or subjects, which it treats, arranged in alphabetical order. It may be either a vocabulary, or collection of the words in a language, with their definitions; or a special work on one or more branches of science or art prepared on the principle of alphabetical arrangement, such as dictionaries of biography, law, music, medicine, etc. The best-known American dictionary of the English language is that by Noah Webster, published in 1828, and since entirely recast. The largest complete English dictionary is the Century Dictionary, Webster's International Dictionary and The Standard Dictionary are other well known American works.

DIDACTIC POETRY, that kind of poetry which professes to give a kind of systematized instruction on a definite subject or range of subjects. In a larger sense of the word most great poems might be called didactic, since they contain a didactic element in the shape of history or moral teaching, Dante's Divina Commedia, Milton's Paradise Lost, or Goethe's Faust, for example. The difference may be said to be this, that in the one case the materials are limited and controlled by nothing but the creative fancy of the poet, while in the other they are much more determined by the actual nature of the subject treated of.

DIDEROT (dēd-rō) Denis, a French writer and philosopher, was born in 1713, at Langres, in Champagne. In 1749 he had begun along with D'Alembert and some others the Encyclopædia. At first it was intended to be mainly a translation of one already published in English by Chambers. Diderot and D'Alembert, however, enlarged upon this project, and made the new Encyclopædia a magnificently comprehensive and bold account of all the thought and science of the time. Diderot, besides revising the whole, undertook at first the mechanical arts, and subsequently made contributions in history, philosophy, and art criticism. But the profits of all his labor were small, and it was only the liberality of the Empress Catharine, who purchased his library for 50,000 livres and made him a yearly allowance of 1000 livres, that saved Diderot from indigence. In 1773 he visited St. Petersburg to thank his benefactress and was received with great honor. On his return to France he lived in retirement, and died in 1784.

DIDUN'CULUS, a genus of birds allied to the pigeons. This bird is of special interest as being the nearest living ally of the extinct dodo. It has a length of about 14 inches, with a glossy plumage

Didunculus strigirostris.

verging from a velvety black on the back to greenish black on the head, breast, and abdomen. The large beak, which is nearly as long as the head, is greatly arched on the upper half, while the lower is furnished with two or three tooth-like indentations.

DIE, a metallic stamp for impressing a design or figure upon coins or other metallic objects. See Die-sinking.

DIEFFENBACH (dē'fen-bâh), Johann Friedrich, German surgeon, born at Königsberg in 1792. Surgery is particularly indebted to him for new methods of forming artificial noses, eyelids, lips, etc., and curing squinting, stammering, etc. He died in 1847.

DI'ELECTRIC, a name applied by Faraday to any medium through or across which electrostatic induction can take place. Faraday first showed that electrostatic induction was not action at a distance, but took place by means of the insulating medium separating the two conductors. The medium he named a dielectric, and measured its specific inductive capacity by taking that of common air as unity.

DIEPPE (dē-ep'), a seaport town, France, department Seine-Inférieure, on the English Channel, at the embouchure of the Arques, 93 miles n.n.w. Paris. The port is spacious, admitting vessels of 1200 tons burden; but it cannot be entered at low water. Dieppe is one of the chief watering-places of France, and is much frequented by visitors in summer and autumn. The manufactures include works in ivory, the most famed in Europe; works in horn and bone, lace-making, sugar-refining, ship-building, etc. Pop. 20,804.

DIE-SINKING is the art of preparing dies for stamping coins, buttons, medallions, jewelry, fittings, etc. The steel for the manufacture of dies is carefully selected, forged at a high heat into the rough die, softened by careful annealing, and then handed over to the engraver. After the engraver has worked out the design in intaglio the die is put through the operation of hardening, after which, being cleaned and polished, it is called a matrix. This is not, however, generally employed in multiplying impressions, but is used for making a punch or steel impression for relief. For this purpose another block of steel of the same quality is selected, and, being carefully annealed or softened, is compressed by proper machinery upon the matrix till it receives the impression. When this process is complete the impression is retouched by the engraver, and hardened and collared like the matrix. Any number of dies may now be made from this punch by impressing upon it plugs of soft steel. In place of this process patterns are now frequently engraved upon rollers for transference to sheet metal by rolling pressure.

DI'ET, a meeting of some body of men held for deliberation or other purposes; a term especially applied to the legislative or administrative assemblies of the German empire, Austria, etc.

DIETET'ICS, that part of medicine which relates to the regulation of diet. The ideal diet is clearly that which, without burdening the viscera uselessly, furnishes all necessary nutritive elements, with due consideration for special physiological conditions in any given case. No single substance contains the elements needed to replace this waste in their requisite proportions, and a mixed diet is therefore necessary. For instance to secure the required amount of carbon a man would need to eat about 4 lbs. of lean beef, while 1 lb. would yield all the nitrogen required; thus, apart from the labor of digesting 4 lbs. of beef, the body would be compelled to get rid of the excess of nitrogen. Bread, on the other hand, has carbon in abundance, but is deficient in nitrogen; so that by

uniting 2 lbs. of bread with ¾ lb. of lean meat, the due proportion of carbon and nitrogen is satisfactorily supplied. Milk and oatmeal taken together also contain nitrogenous and non-nitrogenous substances in nearly the required proportions. A certain proportion of saline matter is also necessary. The nature of the food most suitable for a healthy man is dependent in part upon general conditions such as climate and season, and in part upon special conditions of individual habit. The inhabitants of the arctic regions need large quantities of oleaginous food; those of the tropics live chiefly on starchy products. With increased activity and exertion, as in training, an increase in the nitrogenous foods becomes necessary. In a state of health we need not draw hair-breadth distinctions as to the superior salubrity of the several sorts of diet, the quantity rather than the quality of food being the main consideration. Those persons who have been most remarkable for health and long life have generally been contented with two moderate meals a day which are certainly quite sufficient during a state of health.

In all diseases attended with much fever or quickness of pulse the stomach loathes animal food, and there is generally a great increase of thirst, to quench which water, either quite cold, or iced, or tepid, or rendered acid, may be freely indulged. Infusions, too, of barley, sage, balm, etc., may be taken. In chronic diseases attended with hectic fever, milk is the most proper diet. The best food for infants is, of course, their mother's milk; but whenever they begin to cut teeth a little animal food, such as soft-boiled eggs, beef-tea, and even chicken minced very fine, may be given. Many infants suffer from having too much sugar given them in their food.

DIEU ET MON DROIT (dy*eu* e mon drwä), the motto of the arms of England, first assumed by Richard I., and revived by Edward III. when he claimed the crown of France. Except during the reigns of Elizabeth and Anne, who used the motto Semper eadem, and of William III., who personally used Je maintiendray, it has ever since been the royal motto of England.

DIFFERENTIAL CALCULUS. See Calculus.

DIFFERENTIAL THERMOMETER, an instrument for determining very minute differences of temperature. Leslie's differential thermometer consists of two glass bulbs containing air connected by a bent tube containing some sulphuric acid, the movement of which (as the air expands and contracts) serves to indicate any slight difference of temperature between the two bulbs.

DIFFRAC'TION, a term applied to certain phenomena connected with the modification that rays of light undergo in passing close to the edge of an opaque body. Thus when a beam of direct sunlight is admitted into a dark room through a narrow slit, and falls upon a screen placed to receive it, there appears a line of white light bordered by colored fringes; these fringes are produced by diffraction. See Interference.

DIFFU'SION, the gradual dispersion of particles of one liquid or gas among those of another. Thus, in the case of gases, when a jar of oxygen and a jar of hydrogen are connected together by a tube or opening of any kind, they rapidly become mixed; and their mixture does not depend on gravity, but takes place in opposition to that force, as may be shown by placing the jar of hydrogen gas above the other. Oxygen is sixteen times heavier than hydrogen, bulk for bulk, but the heavier gas moves upward and the lighter downward, and the process of intermixture, or diffusion, goes on till the two gases are apparently equably distributed throughout the whole space. After that they have no tendency whatever to separate. Similarly, if two vessels, one containing oxygen and the other hydrogen, be connected by a tube which is stuffed with a plug of porous material, such as plaster of Paris, the gases gradually diffuse one into the other through the porous plug. The two gases, however, do not pass through the porous separator at equal rates, but in inverse proportion to the square roots of the densities of the gases. Thus in the case of two vessels, one containing hydrogen and the other oxygen, which is sixteen times as heavy as hydrogen, the hydrogen will pass toward the oxygen jar four times as quickly as the oxygen will pass toward the hydrogen jar. Kindred phenomena occur when two liquids that are capable of mixing, such as alcohol and water, are put in contact, the two gradually diffusing one into the other in spite of the action of gravity. In some cases, however, as where ether and water are employed, the diffusion is only partial, extending a comparatively small distance on either side of the original line of separation. When solutions of various solid bodies are placed in contact, interdiffusion also takes place. On the results of his examination of the phenomena of diffusion of liquids and salts across porous membranes or septa, Graham founded a method of separating colloid from crystalloid bodies, which he called dialysis.

DI'GEST, a name originally given to a collection or body of Roman laws, digested or arranged under proper titles by order of the emperor Justinian. Hence applied to any somewhat similar collection.

DIGES'TER, a strong vessel of copper or iron, on which is screwed an air-tight cover with a safety-valve, the object being to prevent loss of heat by evaporation. Water may be thus heated to 400° Fahr.; at which temperature its solvent power is so greatly increased that bones are converted into a jelly.

DIGES'TION is that process in the animal body by which the aliments are so acted upon that the nutritive parts are prepared to enter the circulation, and separated from those which cannot afford nourishment to the body. The organs effecting this process are called the digestive organs, and consist of the stomach, the great and small intestines, etc. (see Intestine, Stomach), the liver, and pancreas. When the aliments, after being properly prepared and mixed with saliva by mastication, have reached the stomach, they are intimately united with a liquid substance called the gastric juice, by the motion of the stomach. By this motion the aliments are mechanically separated into their smallest parts, penetrated by the gastric juice, and transformed into a uniform pulpy or fluid mass. The gastric juice acts upon the albuminous parts of the food, converting them into peptones, which can pass through organic membranes and thus enter the blood. This action is aided by the warmth of the stomach. The pulpy mass, called chyme, proceeds from the stomach, through the pylorus, into that part of the intestinal canal called the small intestine, where it is mixed with the pancreatic juice, bile, and intestinal juice. The pancreatic juice converts starch into sugar, albumins into peptones, and emulsionizes fats, so that all these kinds of food are rendered capable of absorption. The process is aided by the intestinal juice. The bile also acts upon fats, and thus the food is formed into the chyle, which is absorbed into the system by the capillary vessels called lacteals while the non-nutritious matters pass down the intestinal canal and are carried off.

DIGIT (dij'it), in arithmetic, any one of the ten numerals, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0. Digit is also a measure of a finger's breadth, equal to ¾ inch.—Digit, in astronomy, is the measure by which we estimate the quantity of an eclipse. The diameter of the sun or moon's disc is conceived to be divided into twelve equal parts, called digits; and according to the number of those parts or digits which are obscured, so many digits are said to be eclipsed.

DIJON (dē-zhōn), a town in Eastern France, capital of the department Côte-d'Or, in a fertile plain, at the foot of a range of vineclad slopes, formerly surrounded by ramparts, which now furnish beautiful promenades. At some distance it is surrounded by a series of forts. Some of the buildings belong to the period when Dijon was capital of the dukedom of Burgundy, the chief being the cathedral, a building of vast extent with a lofty wooden spire above 300 feet high; the churches of Notre Dame and St. Michael; the ancient palace of the dukes of Burgundy, now used as the hôtel de ville and museum; and the palais de justice, formerly the parliament house of Burgundy. It has important educational institutions and a valuable library. Industries: woolens, hosiery, candles, mustard, vinegar, chemicals, paper-hangings, etc., tanneries, foundries, machine factories, cotton and oil mills. The trade is considerable, particularly in the wines of Burgundy. Pop. 65,428.

DIKE, or **DYKE,** a word variously used in different localities to represent a ditch or trench, and also an embankment, rampart, or wall. It is specially applied to an embankment raised to oppose the incursions of the sea or of a river, the dikes of Holland being notable examples of work of this kind. These are often raised 40 feet above the high-water mark, and are wide enough at the top for a common roadway or canal, sometimes for both. The Helder Dike, one of the largest, is about 6 miles in length and involves an annual outlay of over $30,000.

DIKE, DYKE, in geology, a term applied to intrusions of igneous rock, such as basalt, greenstone, etc., which fill up veins and fissures in the stratified systems, and sometimes project on the surface like walls.

DILEM'MA, in logic, a form of argument used to prove the falsehood or absurdity of some assertion, as in the following instance: If he did go he must be either foolish or wicked; but we know he is neither foolish nor wicked; therefore he cannot have done so. The two suppositions, which are equally untenable, are called the "horns" of the dilemma.

DILETTANTE (di-let-tân'tā), an Italian expression, signifying a lover of the arts and sciences, who devotes his leisure to them as a means of amusement and gratification, being thus nearly equivalent to amateur.

DILL, an umbelliferous plant, a native of the southern countries of Europe, the fruits, commonly but erroneously called seeds, of which are moderately warming, pungent, and aromatic, and are employed medicinally as a carminative. In appearance it resembles the fennel. Dill-seeds yield dill-water, which is used as a remedy in flatulency and gripes of children.

DIL'UENTS, in medicine, are those substances which are taken to increase the proportion of fluid in the blood. They consist of water and watery liquors.

DILU'VIUM, the name formerly given by geologists to certain gravels and comparatively recent deposits, which seem to have been the result of a rush of water or deluge.

DIME, the term for a silver coin, the tenth part of a dollar or ten-cent piece in the United States.

DIMIN'UTIVE, in grammar, a word having a special affix which conveys the idea of littleness, and all other ideas connected with this, as tenderness, affection, contempt, etc. The opposite of diminutive is augmentative. In Latin, diminutives almost always ended in lus, la, or lum; as Tulliola, meum corculum, little Tullia, my dear or little heart; homunculus, a manikin. The Italian is particularly rich in diminutives and augmentatives, such compound diminutives as fratellinucciettinetto (a diminutive of frate, brother) being sometimes employed. Among English diminutive affixes are kin, as in manikin, a little man; pipkin, a little pipe; ling, as in gosling, a little goose; darling, that is, dearling, or little dear; and et, as in pocket, from poke, a bag or pouch; tablet, a little table. Diminutives are also formed, in colloquial and familiar language, by adding y or ie to the names, as Charley, Mousie, etc.

DIM'ITY, a stout cotton fabric, ornamented in the loom either by raised stripes or fancy figures. It is usually employed white, as for bed and bedroom furniture.

DINAJPUR', a town, Hindustan, Bengal, capital of a district of same name, 205 miles north of Calcutta; pop. 12,000. The district covers an area of about 4118 square miles; pop. 1,555,835.

DINGO, the native wild dog of Australia, of a wolf-like appearance and extremely fierce. The ears are short and erect, the tail rather bushy, and the hair of a reddish-dun color. It is very destructive to the flocks, killing more than it eats.

DINO'CERAS, a fossil mammal found in the Eocene strata of N. America, in some respects akin to the elephant and of equal size, but without a proboscis. Its bones were very massive; it had two long tusks in the upper jaw, three pairs of horns, and the smallest brain, proportionally, of any known mammal.

DINOR'NIS, an extinct genus of large wingless birds—classed among the Struthionidæ or ostrich tribe—the bones of five species of which have been found in

Dinornis (pelvic and leg bones and outline of body).

New Zealand. The largest must have stood at least 14 feet in height, several of its bones being at least twice the size of those of the ostrich. The body seems to have been even more bulky in proportion, the tarsus being shorter and stouter in order to sustain its weight. They do not appear to have become extinct until the 17th or 18th century, and are spoken of as moas by the natives, who buried the eggs with their dead as provision for their journey to the other world.

DINOSAU'RIA, a group of colossal lizards, resembling the pachydermatous mammals in general appearance, but in reality intermediate between the struthious birds and lizards. The majority, as the Megalosaurus, which attained to 40 feet in length, were carnivorous; the Iguanodon, however, was herbivorous. They were the land reptiles of the Jurassic, Wealden, and inferior Cretaceous continents.

DINOTHE'RIUM, a genus of extinct gigantic mammals, the remains of which occur in Tertiary formations in several parts of Europe. The largest species is

Dinotherium restored.

calculated to have attained the length of 18 feet. It had a proboscis and also two tusks placed at the anterior extremity of the lower jaw, and curved downward somewhat after the manner of those in the upper jaw of the walrus. The zoological position of the Dinotherium is that of a proboscidean allied to the elephant. The skull, molar teeth, and scapular bone are the only portions yet discovered. Kaup regards it as intermediate between the mastodons and tapirs, and terrestrial; while Blainville and Pictet regard it as allied to the sea-cows, and inhabiting the embouchure of great rivers.

DI'OCESE, the circuit or extent of a bishop's jurisdiction. Each diocese is divided into archdeaconries, each archdeaconry (nominally) into rural deaneries, and each deanery into parishes.

DIOCLE'TIAN, a native of Dalmatia, proclaimed Emperor of Rome by the army 284 A.D. He was compelled by the dangers threatening Rome to share the government with M. Aurelius Valerius Maximian. In 292 C. Galerius and Constantius Chlorus were also raised to a share in the empire, which was thus divided into four parts, of which Diocletian administered Thrace, Egypt, Syria, and Asia. As the result of his reconstitution of the empire there followed a period of brilliant successes in which the barbarians were driven back from all the frontiers, and Roman power restored from Britain to Egypt. In 305, in conjunction with Maximian, he resigned the imperial dignity at Nicomedia, and retired to Salona in Dalmatia, where he cultivated his garden in tranquillity until his death in 313. In the latter part of his reign he was induced to sanction a persecution of the Christians.

DIOGENES of Sinopē, (on the Black Sea) the most famous of the Cynic philosophers, born about 412 B.C. Having been banished from his native place with his father, who had been accused of coining false money, he went to Athens, and thrust himself upon Antisthenes as a disciple. Like Antisthenes he despised all philosophical speculations, and opposed the corrupt morals of his time; but while the stern austerity of Antisthenes was repulsive, Diogenes exposed the follies of his contemporaries with wit and good humor. As an exemplar of Cynic virtue he satisfied his appetite with the coarsest food, practiced the most rigid temperance, walked through the streets of Athens barefoot, without any coat, with a long beard, a stick in his hand, and a wallet on his shoulders, and by night, according to the popular story, slept in a tub (or large earthenware vessel). On a voyage to the island of Ægina he fell into the hands of pirates, who sold him as a slave to the Corinthian Xeniades in Crete. The latter emancipated him, and intrusted him with the education of his children. He attended to the duties of his new employment with the greatest care, commonly living in summer at Corinth and in winter at Athens. He died 323 B.C., at a great age.

DIOMEDES (dī-o-mē'dēz), in Greek mythology, (1) A king of the Bistŏnes, who fed his horses on human flesh, and used to throw all strangers who entered his territories to those animals to be devoured. He was killed by Hercules, who carried off the horses. (2) One of the heroes at the siege of Troy, the son of Tydeus and Deipyle, and king of

Argos, one of the suitors of Helen. After she was carried off Diomedes engaged in the expedition against Troy, in which his courage and the protection of Pallas rendered him one of the most distinguished heroes. He wounded Aphrodite and Ares, and thrice assailed Apollo; and by carrying off the horses of Rhœsus from the enemies' tents, and aiding Ulysses in the removal of Philoctetes from Lemnos, he fulfilled two of the conditions on which alone Troy could be conquered. Finally he was one of the heroes concealed in the wooden horse by whom the capture of Troy was at length accomplished. Different accounts were given of his after-life. He is often called Diomede.

DIONYSIUS of Halicaonassus, in Caria, a Greek critic and teacher of eloquence, born about 70 B.C. He went to Rome about 30 B.C., where he wrote his Roman Antiquities, in twenty books, in which he relates (in Greek) the early history of Rome and its government up to the times of the first Punic war.

DIONYSIUS the Areopagite, that is, one of the judges of the Areopagus, at Athens, a convert to Christianity by the Apostle Paul about the middle of the first century, and the first bishop at Athens, where he suffered martyrdom.

DIONYSIUS the Elder, in Greek history, tyrant or absolute ruler of Syracuse, born about 430 B.C. of obscure parentage. He obtained the rank of general, and afterward of commander-in-chief; and gaining the support of the army, he seized the supreme power in Syracuse, though only twenty-five years of age. He gained a complete victory over the Carthaginians under the walls of Syracuse. In 368 he commenced a new war against the Carthaginians, but failed to drive them entirely out of Sicily. He is said to have died from a potion administered at the instigation of his son Dionysius the Younger (367 B.C.).

DIONYSIUS the Little, a Scythian monk who was abbot of a monastery at Rome in the beginning of the 6th century, and died about the year 530, celebrated as the author of the computation of time from the Christian era. This mode of computation, however, was not publicly used until the 8th century.

DIONYSIUS the Younger, a tyrant of Syracuse, who in 367 B.C. succeeded his father, Dionysius the Elder. For the purpose of recalling him from the excesses to which he was addicted Dionysius persuaded him to invite Plato to his court, but the influence of the philosopher effected no permanent change. Timoleon, who came to Syracuse with aid from Corinth against the Carthaginians, desposed him in 344 B.C.

DIOP'TRICS, that part of optics which treats of the refraction of light passing through different mediums, as through air, water or glass, and especially through lenses. These phenomena, however, are now more commonly treated under the head of refraction.

DIORA'MA, a mode of painting and of scenic exhibition invented by Messrs. Daguerre and Bouton, and first exhibited in 1823. It secures a higher degree of illusion than the ordinary panorama, by a mode of uniting transparent painting to the usual opaque method, and causing the light to fall upon the picture both from before and behind. At the same time, by means of colored transparent blinds, suspended both above and behind the picture, the rays of light can be intercepted and made to fall at pleasure in graduated tints upon every part of the picture in succession.

DIP of the horizon, an allowance made in all astronomical observations of altitude for the height of the eye above the level of the sea.

DIP, in geology, the inclination or angle at which strata slope or dip downward into the earth. The degree of inclination or amount of the dip, which is easily measured by a special instrument, is determined by the angle which a line drawn perpendicular to the direction of the stratum makes with the horizon. The line in which such strata cut the surface is called the strike, and is always at right angles to the dip.

DIPHTHE'RIA, a malignant disease characterized by the formation of a thick leathery false membrane in the throat, and allied to croup, which, indeed, is often considered a form of it, the disease being called diphtheria when it attacks principally the tonsils and parts in their neighborhood, and croup when it principally attacks the larynx. (See Croup.) It has only in recent times attracted public attention by its frequency and peculiar symptoms. It is a most fatal disease, resulting from the introduction into the body of a specific poison, is contagious, often epidemic, and in some places endemic. It is always accompanied by a very low state of the system, indicating the necessity of giving stimulating nourishment very freely. The membrane may spread more or less, going down into the windpipe or up the nose, and death may be caused by suffocation and exhaustion, or the violence of the poison may cause it without the formation of a membrane. The patient's strength must be well kept up, and antiseptic agents applied. Injection of antitoxic serum, from the blood of a horse previously inoculated with the disease, is now successfully employed.

DIPHTHONG, a coalition or union of two vowels pronounced in one syllable. In uttering a proper diphthong both vowels are pronounced; the sound is not simple, but the two sounds are so blended as to be considered as forming one syllable, as in void, bough. The term improper diphthong is applied to the union in one syllable of two or more vowels, of which only one is sounded, as in bean.

DIPLEI'DOSCOPE, an instrument for indicating the passage of the sun or a star over the meridian, by the coincidence of two images of the object, the one formed by single and the other by double reflection. It consists of an equilateral hollow prism, two of whose sides are silvered on the inside so as to be mirrors, while the third is formed of glass. The prism is adjusted so that one of the silvered sides shall be exactly in the plane of the meridian, and the transparent side toward the object.

DIPLO'MA, literally a document folded but once, and therefore divided into two parts. It is used to signify a document signed and sealed, in which certain rights, privileges, dignities, etc., are conferred, especially a university degree.

DIPLO'MACY, the science or art of conducting negotiations, arranging treaties, etc., between nations; the branch of knowledge which deals with the relations of independent states to one another; the agency or management of envoys accredited to a foreign court; the forms of international negotiations. Diplomatic agents are of several degrees: 1, ambassadors; 2, envoys extra ordinary and ministers plenipotentiary; 3, ministers resident; 4, chargés d'affaires; 5, secretaries of legation and attachés. Their rank was regulated in Europe, in the above order, by the congress assembled at Vienna in 1814. Among the European powers it is agreed that of ministers of the same rank he who arrives first shall have the precedence over his colleagues.

DIPPER, a bird of the genus Cinclus, allied to the thrushes. The common dipper is about 7 inches in length, with a very short tail, small rounded wings, and large powerful feet; the bill

Dipper.

is of moderate length, straight, and slender. The male has the upper part of the body dark brown, the throat and breast white, belly rusty. The dipper frequents streams, and feeds largely on water-insects and larvæ. It can dive and walk under water, effecting its progress by grasping the stones with its feet. The song is sweet and lively.

DIPPING-NEEDLE, or **INCLINATION COMPASS,** an instrument for showing the direction of one of the components of the earth's magnetism. In essentials the instrument consists of a light magnetized steel bar supported on a horizontal axis which passes, as nearly as possible, through the center of inertia of the bar. When a needle thus mounted is placed anywhere not in the magnetic equator, it dips or points downward; and if the vertical plane, in which it moves, coincides with the magnetic meridian the position of the needle shows at once the direction of the magnetic force. The intersection of two or more directions found by making the experiment at different places, indicates the place of the magnetic pole.

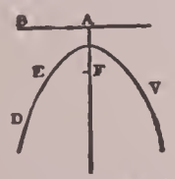
DIPSOMA'NIA, a term recently introduced to denote an insane craving for intoxicating liquors, when occurring in a confirmed or habitual form. It is often of hereditary origin, but may result from sunstroke, from some injury to the brain, or from disease. The only remedy appears to be seclusion, with enforced abstinence and healthy occupation.

DIP'TERA, an order of two-winged insects, of which the common house-fly and blue-bottle are familiar examples.

DIRECTORS, persons elected to meet together at short fixed intervals and consult about the affairs of corporations or joint-stock companies, and to advise and assist the manager. Directors are appointed by a general meeting of the shareholders in the undertaking, and a certain number of them, usually a third, retire every year. Ordinary directors are granted a certain remuneration for their services. The duties and responsibilities of directors are defined by the constitution of the company, or by the various acts of the legislature affecting joint-stock and other companies.

DIREC'TORY, the name given to a body of five officers to whom the executive authority in France was committed by the constitution of the year III. (1795). The two legislative bodies, called the councils, elected the members of the directory: one member was obliged to retire yearly, and his place was supplied by election. This body was invested with the authority, which, by the constitution of 1791, had been granted to the king. By the revolution of the 18th Brumaire the directory and the constitution of the year III. were abolished. It was succeeded by the consulate.

DIREC'TRIX, in math. a line perpendicular to the axis of a conic section, and so placed that the distance from it of any point in the curve is to the distance of



Directrix of a parabola.

the same point from the focus in a constant ratio; also, the name given to any line, whether straight or not, that is required for the description of a curve. The directrix of a parabola is a line perpendicular to the axis produced, and whose distance from the vertex is equal to the distance of the vertex from the focus. Thus A B is the directrix of the parabola V E D, of which F is the focus.

DIRK, a kind of dagger formerly used as a weapon of offense by the Highlanders of Scotland. Dirks are worn by midshipmen and cadets of the English navy, and still form part of the full highland costume.

DISABILITY, in law, incapacity to do any legal act. It is either absolute, which wholly disables the person; such as outlawry or excommunication — or partial, such as infancy, coverture, insanity or drunkenness.

DISBANDING, the breaking up of a regiment or other body of military, and releasing them from service, when they are no longer required, or it may be on account of insubordination.

DISBARRING, expelling an attorney from the bar. The party disbarred may lodge an appeal with the judges in their capacity of citizen.

DISC, DISK, the central part of a radiate compound flower surrounded by the ray. Also a part, sometimes cup-shaped, at the base of the stamens, consisting in some cases of rudimentary stamens, in others of the modified receptacle.—In astronomy the term is applied to the face or circular figure exhibited by the sun, moon, or a planet in the sky.

DISCHARGING ARCH, an arch formed in the substance of a wall to relieve the part which is below it from the super-

Discharging arch.

incumbent weight. Such arches are commonly used over lintels and flat-headed openings.

DISCIPLES OF CHRIST, also called Christians, a religious denomination formed by Thomas Campbell and his son Alexander, their general principle being announced in the aphorism, "Where the scriptures speak, we speak; where the scriptures are silent, we are silent." The denomination sprang up in 1812 in Pennsylvania, and has grown very rapidly until today it numbers nearly 1,500,000. The Christians accept the inspiration of the scriptures, baptize by immersion, and in church government are congregational.

DISCLAIM'ER, in its stricter legal sense, a plea containing renunciation or a denial of some claim alleged to have been made by the party pleading.

DIS'CORD, in music, a dissonant or inharmonious combination of sounds, so called in opposition to the concord. See Dissonance.

DIS'COUNT, the charge made by a banker for interest of money advanced by him on a bill or other document not presently due. In advancing money on such security the banker deducts the charge for interest on his advance from the total amount represented on the security, pays the difference, which is called the proceeds of the bill, to the person parting with it, and collects the full amount to reimburse himself for outlay and interest at maturity. Popularly the term discount is applied to any deduction from the full amount of an account made by the party to whom it is paid, especially on prompt or early payment. When a bill which has been discounted is paid by the acceptor before it is due, the discount allowed for prepayment is called rebate.

DISCOV'ERY, in law, the act of revealing or making known any matter by a defendant in his answer to a bill in chancery. The word is also used in reference to the disclosure by a bankrupt of his property for the benefit of his creditors.

DISCRIMINATION, a term applied to the practice of railroads or other common carriers of favoring certain users of the road, or other utility to the prejudice of other users, particularly in the matter of charges. Railway discrimination has been continuously practiced in the U. States for many years and much legislation has been directed against it, without, it would seem, any useful or efficient result. Federal and state laws against discrimination seem all to be mere dead letters. Similar legislation in England seems to have fallen as far short of the mark as in the U. States.

DISCUS, DISC, or **DISK,** among the Greeks and Romans a quoit of stone or metal, convex on both its sides, sometimes perforated in the middle. The players aimed at no mark, but simply tried to throw the quoit to the greatest possible distance. It was sometimes furnished with a thong of leather to assist in the throwing.

DISEASE, any morbid state of the body, or of any organ or part of the body. Diseases are described as local or constitutional, idiopathic, symptomatic, epidemic, endemic, contagious, acute, chronic, etc. The influence of the parents on the organization of the child is so great that not only peculiarities of external form, but the peculiar constitution, the greater or less activity and development of the organs, are found to pass from parent to child. As it is in the particular state of the several organs and functions that a very great part of diseases have their foundation, the liability to certain diseases is inevitably inherited with the organic structure, and the son is not unfrequently attacked by various complaints at the same period of life in which his father was. These diseases are called hereditary; but it is only the predisposition to them that is, properly speaking, inherited. Hence the actual development of hereditary diseases requires certain cooperating circumstances. Constitutional diseases are very often not hereditary, but depend on circumstances which affect the fetus during pregnancy. Among the diseases which are most frequently hereditary are scrofula, bleeding (especially at the lungs) and hemorrhoids, consumption, gout, the gravel and stone, cancer, disorders of the mind and spirits, hysterical and hypochondriac affections, apoplexy, epilepsy, and organic diseases of particular parts, especially of the heart. Inherited diseases are much more difficult to cure than those which originate in accidental external causes, and special care should therefore be taken to adopt an environment and mode of life calculated to counteract the inherited predisposition. As to the origin of certain diseases see Germ Theory.

DISEASE, FEIGNING OF, a practice used by many persons for the attainment of an end, sometimes fraudulent, sometimes not. A disease commonly simulated is epilepsy, the simulator using a little soap in the mouth for the making of foam at the lips. The detection of such fraud is often quite difficult, but there are certain physiological tests unknown to malingerers which generally disclose the fraud.

DISEASES OF PLANTS may be divided into two main classes: those produced by temperature, excess or deficiency of moisture and light, impure air, the composition of the soil, and other mechanical or chemical agencies; and those produced by other organized be-

ings, whether belonging to the animal or vegetable world.

DISHONOR OF A BILL, the refusal or neglect to accept or pay when due, a bill of exchange, or promissory note, or draft on a banker. It is absolutely necessary that the holder of a dishonored bill should give immediate notice of the non-payment to the drawer or indorsers.

DISINFEC'TANT, any substance that destroys the germs of contagious and infectious diseases. The most important for practical purposes are chlorine, carbolic acid, sulphurous acid, manganate and permanganate of potash, chloride of zinc. Carbolic acid is one of the most effective, needing, however, some little care in the handling, as it sometimes causes severe burns. It does not in its common form mix with water, but floats on the surface undiluted. In cases of infectious or contagious disease, disinfectants such as chlorinated lime or carbolic acid should at once be placed about the house, especially in the sick room and in the passages and landing outside it. A large sheet also should be nailed so as to hang across the door, and this should be kept constantly wet with carbolic acid. All excretions should be instantly disinfected and also the closet which receives them. In a country place it is best to bury them in a considerable depth of earth. Every article of clothing and furniture should be carefully treated, as the germs may lurk in them and break out after a lapse of months or years.

DISIN'TEGRATOR, a machine for pulverizing and sometimes for mixing various materials, such as rock, asphalt, ore, artificial manures, sugars, corn, the ingredients of mortar, etc.

DISLOCA'TION, a surgical term applied to cases in which the articulating surfaces of the bones have been forced out of their proper places. The particular dislocation takes its name either from the joint itself or its furthest bone, and is called compound when accompanied with an external wound. The most common dislocations are those of the hip, shoulder, elbow, knee, and ankle, and the chief obstacle to their reduction is the spasmodic and violent contraction of the muscles consequent upon them, the application of considerable force being often necessary to set the joint. Chloroform is of great use, not only in preventing pain but in relaxing the muscles. The most dangerous dislocations are those of the bones of the spine. —In geology it signifies the displacement of parts of rocks or portions of strata from the situations they originally occupied.

DISMAL SWAMP, a large tract of marshy land in America, beginning a little south of Norfolk, in Virginia, and extending into North Carolina, containing 150,000 acres: 30 miles long, from north to south, and 10 broad. This tract was entirely covered with trees, with almost impervious brushwood between them, but it has now in part been cleared and drained.

DISPEN'SARY, a charitable institution for the free supply of medicine to the poor. Each institution has one or more physicians, surgeons, and apothecaries, who attend at stated times in order to prescribe for the sick, and, if necessary, to visit them at their own habitations. A note from a subscriber or governor is usually required by would-be patients. Provident dispensaries are similar institutions in which a small fee is exacted.

DISPERSION, an optical term applied to the angular separation experienced by the component rays of a pencil of light on emerging from a refracting medium, whose surfaces are not parallel to each other, e. g. the common prism. The length of the spectrum and the relative space occupied by the colored rays vary greatly according to the refracting medium, the spectrum from a prism of oil of cassia being two or three times longer than one formed by a glass prism.

DISRAELI, Benjamin. See Beaconsfield.

D'ISRAELI (diz-rā'e-li), Isaac, man of letters, and father of the well-known statesman, was born at Enfield, Middlesex, in 1766. An anonymous reply to Peter Pindar, entitled On the Abuse of Satire, was followed in 1791–1793 by the appearance of his Curiosities of Literature, the success of which determined much of his afterwork. He died in 1848.

DISSEN'TERS, the common name by which in Britain all Christian denominations, excepting that of the Established Churches, are usually designated, though in acts of parliament it generally includes only Protestant dissenters, Roman Catholics being referred to under their specific name.

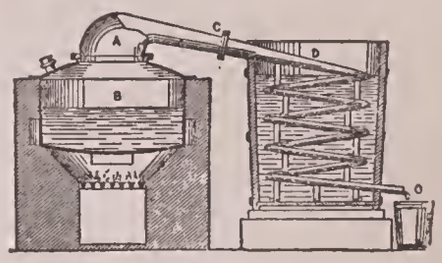
DISSOCIATION, a chemical term used to express the partial decomposition which takes place when chemical compounds are exposed to a high temperature; as when by the passage of steam through a white-hot platinum tube some of it is decomposed and an explosive mixture of oxygen and hydrogen may be collected.

DISSOLVING VIEWS are paintings upon glass magnified and thrown with great distinctness upon a screen by means of one or two magic lanterns with strong lenses, and illuminated by the oxyhydrogen light. If one lantern is used the picture is drawn out of focus gradually, and a second substituted, which is brought gradually into focus, thus producing the haze and brilliancy which have gained this sort of exhibition its name. If two lanterns are used, they are placed side by side with their lens tubes slightly convergent, so that the images may be superposed on the screen. By means of a revolving shutter either lantern can be wholly or partially shut off and the image of other lanterns be correspondingly disclosed.

DIS'TAFF, the first instrument employed in spinning. It consisted of a staff, on one end of which the wool or flax was rolled. The spinner held it in the left hand, and drew out the fibers with the right, at the same time twisting them. A small piece of wood called a spindle was attached to the thread, the weight of which carried it down as it was formed. When the spindle reached the ground the thread which had been spun was wound round it, and it was then again fastened near the beginning of the new thread.

DISTEMP'ER, a disease of the dog commonly considered as of a catarrhal nature. In most cases a running from the nose and eyes is one of the first and chief symptoms, the defluction becoming after some time mucous and purulent. The animal is subject to violent fits of coughing combined with vomiting, loses its appetite, its flesh begins to waste, and if the disease be virulent, symptoms of affection of the brain manifest themselves, accompanied by fits, paralysis, or convulsive twitchings. In the first stage of the disease laxatives, emetics, and occasional bleeding are the principal remedies; diarrhœa should be checked by astringents, and to reduce the violence of the fits warm bathing and antispasmodics should be resorted to. The distemper is generally contagious, and occurs but once in a lifetime.

DISTILLATION, the volatilization and subsequent condensation of a liquid by a special apparatus, resulting in the separation of the liquid from a mixture. The operation is performed by heating



Distilling apparatus.

the crude liquid or mixture in a retort or vessel known as the body of the still. This is made of various shapes and materials, and is closed with the exception of a slender neck which opens into the condenser, a long tube through which the hot vapor from the still is passed. The tube is kept at a sufficiently low temperature to cause the vapor to condense, the common method of securing this being to surround the tube with a constantly renewed stream of cold water. In some cases ice or a freezing mixture may be required to effect condensation. On a large scale the condensing tube is coiled round and round in a tub or box, and is known as a worm. From the end of it the vapor condensed into a liquid drops or distils into a receiver. The simplest case of distillation is that of water containing solid matter in solution, the solid matter remaining behind in the still or retort while the water trickles pure into the receiver. The cut which represents a simple form of still, shows b, a copper boiler, the "body" of the still, a being the "head," and c the "neck," which communicates with the spiral worm d placed in a vessel which contains cold water, the distilled liquid trickling out at o. The cold water round the worm requires to be continually renewed, as otherwise it gets heated. When the mixture to be distilled consists of two or more fluids of different boiling-points, such as alcohol and water the more volatile comes off first, accompanied by a certain proportion of the vapor of the other, so that it is hardly possible completely to separate bodies by one distillation. This is effected by

repeated successive distillations of the liquid with or without the addition of substances to retain the impurities. When the production of one of the ingredients only is aimed at by this process, it is called rectification, but when it is desired to separate and collect all the liquids present, or to divide a mixture into portions lying within certain ranges of temperature ascertained either by the thermometer or by the amount of liquor run off, or by the appearance of the distillate, etc., the process is called fractional distillation. In the laboratory, distillation is employed for purifying water, for recovering alcohol and ether, for the preparation, purification, and separation of a great number of bodies. On the large scale distillation is employed in the preparation of potassium, sodium, zinc, mercury; of sulphuric acid, ether, chloroform, sulphide and chloride of carbon, essential oils and perfumes; purification of coal and wood tar, and the products obtained from them; and most extensive of all, the manufacture of whisky, brandy, or other spirit. Sea-water is also distilled in many cases for drinking or cooking purposes. Destructive distillation differs from the preceding in this respect, that the original substance is not merely separated into the bodies by the mixture of which it is formed, but is so acted on that it is completely decomposed, and bodies are produced which had no existence in the original matter. The term is restricted to the action of heat upon complex organic substances out of contact with the air. The products of destructive distillation are numerous and varied. On the manufacturing scale the process is conducted sometimes for one part, sometimes for another part of the products. Coal, for example, is distilled primarily for the gas, but also for ammoniacal water, benzol, anthracene, and sometimes for the sake of the fixed carbon or coke, the volatile portions being neglected and practically wasted. Wood is distilled partly for the sake of the pyroligeneous acid and the tar, partly for the charcoal. Bones are distilled for the sake of the charcoal, though the oil is also collected. Shale is distilled solely for the sake of the oil.

DISTRESS', in law, is the taking of a personal chattel of a wrong-doer or a tenant, in order to obtain satisfaction for the wrong done, or for rent or service due. If the party whose goods or cattle are seized disputes the injury, service, duty, or rent, on account of which the distress is taken, he may replevy the things taken, giving bonds, at the same time, to return them or pay damages in case the party making the distress shows that the wrong has been done, or the service or rent is due. Another description of distress is that of attachment, to compel a party to appear before a court when summoned for this purpose. The distresses most frequently made in England are on account of rent and taxes and damage-feasance.

DISTRICT ATTORNEY, a public prosecutor of the federal district or (in many states) the county courts. U. States district attorneys are appointed by the president and their compensation is in the form of fees.

DISTRICT COURT, a court the jurisdiction of which is restricted to one section of territory. Several of the states are so divided into districts. In the federal judiciary, a court having jurisdiction in one of the districts into which each of the nine circuits of the U. States is divided.

DISTRICT OF COLUMBIA, a territory of sixty miles area between Maryland and Virginia, occupied by the city of Washington. The district is governed by three commissioners appointed by the president and approved by the senate. (See Washington.)

DISTRICTS, Congressional, the divisions in the U. States which each return a member to congress. Their number varies at different times, being fixed after each decennial census. At present (1907) they are 386.

DITCH, a trench in the earth made by digging, particularly a trench for draining wet land, or for making a fence to guard inclosures.

DITMARSHES, a district of Holstein, in Germany, between the mouths of the Elbe and the Eider, are so little raised above the sea as to require the protection of strong embankments. The area is 500 sq. miles. and the total pop. above 70,000.

DIURET'ICS, medicines intended to increase the secretion and discharge of urine. They either act directly on the kidneys, exciting these organs to increased action; or indirectly by influencing the circulation first. Of the first class are squill, broom, juniper, alcohol, potash, etc.; of the second, digitalis, elaterium, cream of tartar, etc.

DIVAN, a Persian word having several significations. It is used in Turkey for the highest council of state, the Turkish ministry; and for a large hall for the reception of visitors. Among several oriental nations this name is given to certain collections of lyric poems by one author. The divans of Hafiz and Saadi, the Persian poets, are among the most important. In Western Europe the term is applied to a café, and to a kind of cushion seat.

DIVERS, birds remarkable for the habit of diving. The divers are a family of swimming birds, characterized by a strong, straight, rather compressed pointed bill about as long as the head; a short and rounded tail; short wings; thin, compressed legs, placed very far back, and the toes completely webbed. They prey upon fish, which they pursue under water, making use partly of their wings, but chiefly of their legs and webbed feet in their subaqueous progression. These birds inhabit the Arctic seas of the New and Old Worlds; they are abundant in the Hebrides, Norway, Sweden, and Russia. The great northern diver, loon, or ember goose is about 2¾ feet long, and is of handsome plumage.

DIV'IDEND, lit. what is to be divided, a term used in arithmetic and in reference to stocks, etc. In the latter sense it is the interest or profit of stocks divided among, and paid to, the owners. It also signifies the payment made to creditors out of the estate of a bankrupt.

DIVIDERS, a pair of compasses or similar instrument.

DIVIDING ENGINE, a machine for marking the divisions on the scales of scientific, mathematical, or other instruments. Some of these perform work of extraordinary fineness and accuracy.

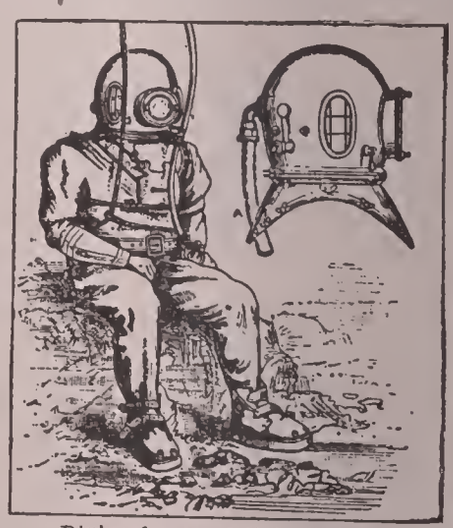
DIVINA COMMEDIA. See Dante.

DIVINATION, the act of divining; a foretelling future events, or discovering things secret or obscure, by the aid of superior beings, or by other than human means. In ancient times divination was divided into two kinds, natural and artificial. Natural divination was supposed to be effected by a kind of inspiration or divine afflatus; artificial divination was effected by certain rites, experiments, or observations, as by sacrifices, observation of entrails and flight of birds, lots, omens, position of the stars, etc.

DIVINE RIGHT, the claim set up by some sovereigns or their supporters to the absolute obedience of subjects as ruling by appointment of God, insomuch that, although they may themselves submit to restrictions on their authority, yet subjects endeavoring to enforce those restrictions by resistance to their sovereign's acts are considered guilty of a sin.

DIVING, the art or act of descending into water to considerable depths, and remaining there for a time. The uses of diving are important, particularly in fishing for pearls, corals, sponges, examining the foundations of bridges, recovering valuables from sunken ships, and the like. Without the aid of artificial appliances a skilful diver may remain under water for two, or even three minutes; accounts of longer periods are doubtful or absurd. Various methods have been proposed and engines contrived to render diving more safe and easy. The great object in all these is to furnish the diver with fresh air, without which he must either make but a short stay under water or perish,

DIVING-BELL, a contrivance for the purpose of enabling persons to descend and to remain below the surface of water



Diving-dress and diving-helmet.
a, Pipe by which air is supplied; *b*, valve by which it escapes.

for a length of time, to perform various operations, such as examining the foundations of bridges, blasting rocks, recovering treasure from sunken vessels, etc. Diving-bells have been made of

various forms, more especially in that of a bell or hollow truncated cone, with the smaller end close, and the larger one, which is placed lowermost, open. The air contained within these vessels prevents them from being filled with water on submersion, so that the diver may descend in them and breathe freely for a long time, provided he can be furnished with a new supply of fresh air when the contained air becomes vitiated by respiration. The diving-bell is generally made of cast-iron, and has several strong convex lenses set in the upper side or roof, to admit light to the persons within. It is suspended by chains from a barge or lighter, and can be raised or lowered at pleasure upon signals being given by the persons within, who are supplied with fresh air injected into a flexible pipe by means of forcing pumps placed in the lighter, while the heated air escapes by a cock in the upper part of the bell. A form, called the nautilus, has been invented which enables the occupants, and not the attendants above, to raise or sink the bell, move it about at pleasure, or raise great weights with it and deposit them in any desired spot.

DIVING-DRESS, a waterproof dress of india-rubber cloth used by professional divers, and covering the entire body except the head. The dress has a neck-piece or breastplate, fitted with a segmental screw bayonet joint, to which the head-piece or helmet, the neck of which has a corresponding screw, can be attached or removed. The helmet has usually three eyeholes, covered with strong glass, and protected by guards. Air is supplied by means of a flexible tube which enters the helmet and communicates with an air-pump above. To allow of the escape of the used air there is sometimes another flexible tube, which is led from the back part of the helmet to the surface of the water. But in the more improved forms of the dress, the breathed air escapes by a valve so constructed as to prevent water from getting in, though it lets the air out. Leaden weights are attached to the diver, and his shoes are weighted, that he may be able to descend a ladder, walk about below, etc. Communication can be carried on with those above by means of a cord running between the diver and the attendants; or he may converse with them through a speaking tube or a telephonic apparatus. One form of diving-dress makes the diver independent of any connection with persons above the water. It is elastic and hermetically closed. A reservoir containing highly compressed air is fixed on the diver's back, which supplies him with air by a self-regulating apparatus at a pressure corresponding to his depth. When he wishes to ascend he simply inflates his dress from the reservoir. Another form, known as the Fleuss dress, makes the diver also independent of exterior aid. The helmet contains a supply of compressed oxygen, and the exhaled breath is passed through a filter in the breast-piece which deprives it of its carbonic acid, while the nitrogen goes back into the helmet to be mixed with the oxygen, the supply of which is under the diver's own control, and to be breathed over again. A diver has remained an hour and a half under 35 feet of water in this dress. The safe limit of depth at which operations can be carried on with the diving-dress is 120 to 150 feet. Diving for pearls, sponges, or corals is now to a great extent carried on by means of diving-dresses.

DIVINING-ROD, a rod, usually of hazel, with two forked branches, used by persons who profess to discover minerals or water under ground. The rod, if carried slowly along by the forked ends, dips and points downward, it is affirmed, when brought over the spot where the concealed mineral or water is to be found. The use of the divining-rod is still common in many parts, and quite recently various wonderful instances of its efficacy in discovering water have been published in respectable prints.

DIVISIBIL'ITY, that general property of bodies by which their parts or component particles are capable of separation. Numerous examples of the division of matter to a degree almost exceeding belief, may be easily instanced. Thus glass test-plates for miscroscopes have been ruled so fine as to have 225,000 spaces to the inch. Cotton yarn has been spun so fine that one pound of it extended upward of 1000 miles, and a Manchester spinner is said to have attained such a marvelous fineness that one pound would extend 4770 miles. One grain of gold has been beaten out to a surface of 52 square inches, and leaves have been made 367,500 of which would go to the inch of thickness. Iron has been reduced to wonderfully thin sheets. Fine tissue paper is about the 1200th part of an inch in thickness, but sheets of iron have been rolled much thinner than this, and as fine as one 4800th part of an inch in thickness. Wires of platinum have been drawn out so fine as to be only the 30,000th part of an inch in diameter. Human hair varies in thickness from the 250th to the 600th part of an inch. The fiber of the coarsest wool is about the 500th part of an inch in diameter, and that of the finest only the 1500th part. The silk line, as spun by the worm, is about the 5000th part of an inch thick; but a spider's line is only the 30,000th part of an inch in diameter; insomuch that a single pound of this attenuated substance might be sufficient to encompass our globe. The trituration and levigation of powders, and the perennial abrasion and waste of the surface of solid bodies, occasion a disintegration of particles almost exceeding the powers of computation. The solutions of certain saline bodies, and of other colored substances, also exhibit a prodigious subdivision of matter. A single grain of the sulphate of copper or blue vitrol, will communicate a fine azure tint to five gallons of water. In this case the sulphate must he attenuated at least 10,000,000 times. Odors are capable of a much wider diffusion. A single grain of musk has been known to perfume a large room for the space of twenty years. At the lowest computation the musk had been subdivided into 320 quadrillions of particles, each of them capable of affecting the olfactory organs.

DIVISION, in arithmetic, the dividing of a number or quantity into any parts assigned; one of the four fundamental rules, the object of which is to find how often one number is contained in another. The number to be divided is the dividend, the number which divides is the divisor, and the result of the division is the quotient. Division is the converse of multiplication.

DIVISION, in military matters, a portion of an army consisting of two or more brigades, composed of the various arms of the service, and commanded by a general officer. In the navy, a select number of ships in a fleet or squadron of men-of-war. The term is now practically abolished since the introduction of gigantic heavily-armed iron-clad ships into the navy.

DIVISION OF LABOR, a principle employed in great industries for the simplification of the work to be done by each of the workmen engaged in it. The separation of complicated processes into a series of simple operations not only results in a great saving of time, but also demands much less ability on the part of the workman, in order that he may acquire the necessary skill in performing any particular operation. Owing to both of these causes, the saving of time, and the employment of cheaper labor, the cost of producing complicated articles is, by the application of this principle, immensely reduced. Division of labor tends to the invention of machinery, and to the effectual use of machinery when invented. It increases the skill and dexterity of the individual workman; it effects a great saving of time and capital, and it conduces to the more economical distribution of labor by classing work-people according to their capacity. It has, however, a deteriorating effect on the laborer's usefulness as an all-round workman.

DIVORCE is a separation, by law, of husband and wife, and is either, a complete dissolution of the marriage bonds, or a divorce, whereby the parties are legally separated, but not unmarried. The causes admitted by different codes of laws as grounds for the modification or entire dissolution of the marriage contract, as well as the description of tribunal which has jurisdiction of the proceedings, and the form of the proceedings, are various. Divorce was permitted by the law of Moses, but forbidden in the New Testament, except for unchastity. The early laws of Rome permitted the husband to divorce his wife for adultery and many other alleged offenses. The facility of divorce continued, without restriction, under the Roman emperors, but as the modern nations of Europe emerged from the ruins of the Roman Empire, they adopted the doctrine of the New Testament. Marriage, under the Roman Church, instead of a civil contract, came to be considered a sacrament of the church, which it was unlawful to dissolve. In the United States, marriage, though it may be celebrated before clergymen as well as civil magistrates, is considered to be a civil contract, and the laws as to divorce, and the facility or difficulty of obtaining it, differ greatly in the several states. In France divorce was legalized

in 1884, with conditions, after having been prohibited for many years.

DIXON, William Hepworth, miscellaneous writer, born at Manchester 1821, died in London 1879. He published several very popular works, including the Personal History of Lord Bacon, The Holy Land, and New America, the last being followed by Spiritual Wives; in the last ten years of his life, he gave to the world somewhere about twenty-five volumes of history, travel, and fiction, among others, Free Russia; Her Majesty's Tower; The Switzers; History of Two Queens, Catharine of Aragon and Anne Boleyn; Diana Lady Lyle, and Ruby Grey (both novels); and his last work, Royal Windsor.

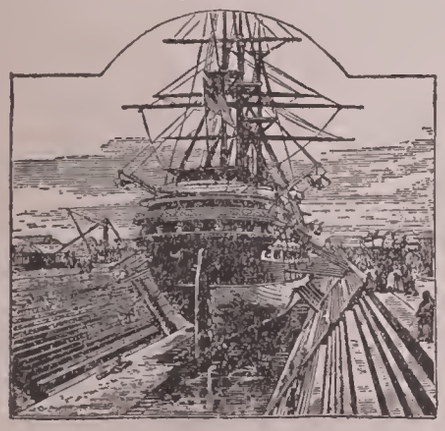
DJOKDJOKARTA, a Dutch residency in the island of Java, on the south coast, with a capital of the same name. Pop. 441,800. The town is large and regular, and contains the sultan's water-palace, and the seat of the Dutch resident, which is a fort commanding both the palace and the town. Pop. 45,000.

DNIEPER (nē'pėr), a great river of Russia which rises in the government of Smolensk, flows first southwest, then southeast, and latterly again southwest to the Black Sea. It begins to be navigable a little above Smolensk, and has a total length, including windings, of 1230 miles. Since 1838 there have been steamboats on the river, and the trade carried by it is considerable.

DNIESTER (nēs'tėr), a large river of Europe, which has its source in the Carpathian Mountains, in Austrian Galicia, enters Russia at Chotin, and empties itself into the Black Sea, after a course of about 750 miles. Its navigation is difficult on account of frequent shallows and rapids.

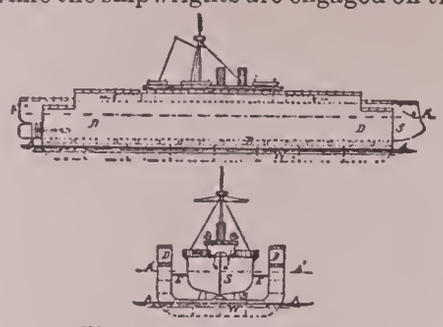
DOBRUD'SHA, The, a territory forming part of the kingdom of Roumania, included between the Danube, which forms its boundary on the west and north, the Black Sea on the east, and on the south by a line stretching from Silistria to a point a few miles south of Mangalia. Pop. about 100,000.

DOCKS are usually artificial inclosures for the reception of vessels, and provided with gates to keep in or shut out the tide.



Dry or graving dock.

They are called wet-docks when they are intended to receive vessels for loading and unloading, the gates being in this case constructed so as to keep in the tide, and thus preserve the water within the docks as nearly as possible at the uniform level of high water. They are called dry-docks, or graving-docks, when they are intended to admit vessels to be examined and repaired, the gates in this case being such as to keep out the tide while the shipwrights are engaged on the



Side and End Elevations of Floating Dock.
A, A, water-line; *A', A'*, immersed water-line for taking in ships; *B*, blocks for supporting ships; *D, D*, dock; *E, E*, shores for side support; *S*, ship raised on dock; *W*, water-tight compartments.

vessel. There is another kind of dry-docks called floating-docks, which float on the surface of the water, and may be sunk sufficiently to allow of a vessel being floated into them, and then raised again, by pumping the water out of the tanks round the sides. One of the chief uses of a wet-dock is to keep a uniform level of water, so that the business of loading and unloading ships can be carried on without any interruption and without danger of damage to the vessel from straining, low tides, storms, etc.

Graving-docks are built of strong masonry, and their entrance is closed either by swinging gates opening in the middle, and when shut presenting a salient angle to the water in the river or harbor from which the dock is entered, or by a framework called a caisson, built like the hull of a ship, with a keel and a stem at both ends. When the caisson is empty it floats, and may be removed to admit of a vessel being floated into the dock. The caisson being then placed at the entrance and filled with water, again sinks into the grooves intended for it and closes the graving-dock. The water is then pumped out, leaving the ship dry and supported by wooden blocks and props. With regard to floating-docks, a common type of construction is the iron floating-dock built in water-tight compartments, and not closed in at either end. It is sunk to the required depth by the admission of water into so many of the compartments, till the vessel to be docked can float easily above its bottom, and it is then raised by pumping out the water until the ship can be propped up as in a dry-dock.

A kind of dry-dock, called the hydraulic lift dock, consists of a double row of iron columns, each of which contains a hydraulic press. All these hydraulic presses can be worked simultaneously by a powerful steam-engine, and their combined action has the effect of raising a series of transverse iron girders stretching from the columns on one side to those of the other. An iron pontoon is first floated above these girders, and then sunk so as to rest on them, and the ship to be docked is floated above the pontoon and supported by blocks resting only upon the pontoon, so that the ship is in no way connected with the columns on each side. The hydraulic presses are then set to work, the girders with the pontoon and ship are raised high enough for the water to be run out of the pontoon, which is then sufficiently buoyant to float the ship. The pontoon may now be floated away clear of the dock, and another take its place. By this plan a number of vessels can be floated for overhauling and repairs in very shallow water at comparatively slight expense.

DOCTOR, a term literally signifying teacher. In the middle ages, from the 12th century, it came into use as a title of honor for men of great learning, such as Thomas Aquinas (Doctor Angelicus), Duns Scotus (Doctor Subtilis), etc. It was first made an academical title by the University of Bologna, and emperors and popes soon afterward assumed the right of granting universities the power of conferring the degree in law. The faculties of theology and medicine were soon included, but for a long time the faculty of arts retained the older title of Magister, till the German universities substituted that of Doctor. The title of Doctor is in some cases an honorary degree, and in other cases (as in medicine and science) conferred after examination. The title of D.C.L. (Doctor of Civil Law). for example, at the University of Oxford and at Trinity College, Dublin, is an honorary degree, and so also are those of D.D. (Doctor of Divinity) and LL.D. (Doctor of Laws) at various universities. The popes and the archbishops of Canterbury exercise the right of conferring the degree of Doctor both in law and divinity.

DODGE, Mary Abigail, an American writer, better known as Gail Hamilton, born at Hamilton, Mass., in 1830, died in 1896. Her work was ephemeral, chiefly on current topics, but possessed a crispness that made it in demand.

DODGE, Mary Elizabeth Mapes, an American poet, editor, and writer, born in New York in 1838. She was editor of St. Nicholas for many years. One of her best known works is Hans Brinker, or, The Silver Skates, which still retains its place, although published in 1865. This work was translated into several European languages and crowned by the French academy.

DODO, an extinct genus of birds once abundant on the island of Mauritius, and assigned by naturalists to the order Columbæ or pigeons, though an extreme modification of the type. It was a mas-

Dodo.

sive clumsy bird, larger than a swan, covered with down instead of feathers with short ill-shaped legs, a strong bulky hooked beak, and wings and tail so short as to be useless for flight.

DOE, John, and Richard Doe, two fictitious personages of the English law who formerly appeared in a suit of

ejectment. This fictitious form of procedure was abolished in 1852.

DOG, a well-known mammal, largely domesticated, carnivorous in the wild state, of very high intelligence, and, of all the lower animals the most closely associated with man in sympathy and sociality. Wild dogs exist in Asia and Australia and all domesticated dogs are derived from some form of the wild animals, or from the mingling of various strains under domestication.

No one probably has ever attempted to make a complete catalogue of the varieties of domestic dogs known throughout the world, but Fitzinger estimated the number in 1876 at about 185. All these fall into certain groups, or types, as will presently be noted; and the study of their points of likeness and unlikeness has been made by several recent investigators of the law of variation.

Breeds of dogs have been variously classified. One Roman grouping mentioned by old writers was into fighters (pugnaces), wise dogs (sagaces), and swift-footed ones (celeres); the sagaces were said to have come from Greece, and the pugnaces from Asia. Another ancient grouping was into house-dogs, sheep-dogs, and sporting-dogs, the last embracing fighters, hounds hunting by scent, and hounds hunting by sight. Modern naturalists have substantially agreed upon six groups, with considerable differences in composition, however. Thus Col. Hamilton Smith, about 1830, arranged the list as follows: The wolf-dogs, including the Siberian dog, Eskimo dog, Iceland dog, Newfoundland dog, Nootka dog, sheep-dog, great wolf-dog, great Saint Bernard dog, Pomeranian dog, etc. The watch and cattle dogs, including the German boarhound, Danish dog, matin, dog of the North American Indians, etc. The greyhounds, including the Brinjaree dog, different kinds of greyhound, Irish hound, lurcher, Egyptian street dog, etc. The hounds, including the bloodhound, old southern hound, staghound, foxhound, harrier, beagle, pointer, setter, spaniel, springer, cocker, Blenheim dog, water-dog or poodle, etc. The cur dogs, including the terrier and its allies. The mastiffs, including different kinds of mastiff, the bulldog, pug dog, etc.

The latest arrangement is that by Windle, based upon the shape of the skull and other features, rather than upon form and function, yet not greatly different from its predecessors. It is as follows: Wolf-like Dogs. — Arctic sledge-dogs; shepherd dogs (collies); Newfoundland dog; Saint Bernard, rough and smooth, and Pomeranian or Spitz dog. Greyhound.—Old Irish wolf-dog; modern Irish wolf-dog; greyhound; Italian greyhound; West Indian naked dog. Spaniels. — All varieties. Hounds.—Bloodhound; foxhound; harrier; otter-hound, beagle, pointer, setter, etc., (hunting-dogs).

DOG-BANE, an American plant found from Canada to Carolina. The whole plant is milky; the root is intensely bitter and nauseous, and is employed in America instead of ipecacuanha.

DOG-CART, a sort of double-seated gig for four persons, those before and those behind sitting back to back; it is often furnished with a boot for holding dogs.

DOG-DAYS, the name applied by the ancients to a period of about forty days, the hottest season of the year, at the time of the heliacal rising of Sirius, the dog-star. The time of the rising is now, owing to the precession of the equinoxes, different from what it was to the ancients (1st July); and the dog-days are now counted from 3d July to Aug. 11, that is, twenty days before and twenty days after the heliacal rising.

DOG-FISH, a name given to several species of small shark, common around the British isles. The rough skin of one of the species, the lesser-spotted dog-fish, is used by joiners and other artificers in polishing various substances, particularly wood. This species is rarely 3 feet long. The greater dog-fish is in length from 3 to 5 feet. It is blackish-brown in color, marked with numerous small dark spots. Both species are very voracious and destructive. Their flesh is hard, dry, and unpalatable. The common or picked dog-fish is common in British and N. American seas, and is sometimes used as food. It is fierce and voracious.

DOGGER, a Dutch vessel equipped with two masts and somewhat resembling a ketch. It is used particularly in the German Ocean for the cod and herring fisheries.

Dutch dogger.

DOGMA, an article of religious belief, one of the doctrines of the Christian faith. The history of dogmas, as a branch of theology, exhibits in a historical way the origin and the changes of the various Christian systems of belief, showing what opinions were received by the various sects in different ages of Christianity, the sources of the different creeds, by what arguments they were attacked and supported, what degrees of importance were attached to them in different ages, the circumstances by which they were affected, and the mode in which the dogmas were combined into systems.

DOGMAT'ICS, a systematic arrangement of the articles of Christian faith (dogmas), or the branch of theology that deals with them. (See Dogma.) The first attempt to furnish a complete and coherent system of Christian dogmas was made by Origen in the 3d century.

DOG-STAR, a name for Sirius, the star that gives their name to the dog-days (which see).

DOILEY, a small ornamental napkin used at table to set glasses on at dessert.

DOL'DRUMS, among seamen, the parts of the ocean near the equator that abound in calms, squalls, and light baffling winds.

DOLE, Nathan Haskell, an American editor, born in Massachusetts in 1852. He has translated Daudet, Tolstoi, and other foreign authors with much success, and has published a number of original poems and essays.

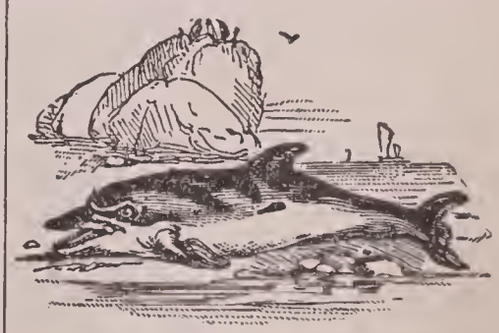
DOLE, Sanford Ballard, an Hawaiian agitator, revolutionist, and statesman, born in Honolulu in 1844. He was president of the provisional government in 1893, and in 1894 was elected president of the Hawaiian republic. He is a most capable jurist.

DOLLAR, the unit of money in the U. States and Canada. The American dollar was established by act of congress in 1792. The silver dollar consists of 412½ grains .900 fine, and the gold dollar of 25.8 grains .900 fine. The gold dollar was made the standard by the act of March 14, 1900, but no coin of that description has been made.

DOL'MAN, a long robe worn by the Turks as an upper garment. It is open in front, and has narrow sleeves. It has given its name to a kind of loose jacket worn by ladies.

DOL'OMITE, a mineral, also called magnesian limestone. It is composed of carbonate of calcium and carbonate of magnesium, and varies from gray or yellowish-white to yellowish-brown.

DOLPHIN, a cetaceous animal, which includes also the porpoises and narwhal. Dolphins are cosmopolite animals, inhabiting every sea from the equator to the poles; they are gregarious, and swim with extraordinary velocity. The common dolphin measures from 6 to 10 feet in length, has a long, sharp snout with numerous nearly conical teeth in both jaws; its flesh is coarse, rank, and disagreeable, but is used by the Laplanders as food. It lives on fish, mollusca, etc., and often may be seen in numbers round shoals of herring. The animal has to come to the surface at short intervals to breathe. The blow-hole is of a semilunar form, with a kind of valvular apparatus, and opens on the vertex, nearly over the eyes. The structure of the ear renders the sense of hearing very acute, and the animal is observed to be attracted by regular or harmonious sounds. One or two young are produced by the female, who



Common dolphin.

suckles and watches them with great care and anxiety, long after they have acquired considerable size.

DOM, a Portuguese title corresponding with the Spanish Don.

DOMAIN', same as Demesne (which see); also applied especially to crown lands or government lands.—Right of eminent domain, the dominion of the sovereign power over all the property within the state, by which it is entitled to appropriate any part necessary to the public good, compensation being given.

DOME, a vaulted roof of spherical or other curvature, covering a building or part of it, and forming a common feature in Byzantine and also in

Section of dome of San Pedro in Montorio, Rome, end of 15th century.

Renaissance architecture. Cupola also is used as a synonym, or is applied to the interior, dome being applied to the exterior. Most modern domes are semielliptical in vertical section, and are constructed of timber; but the ancient domes were nearly hemispherical, and constructed of stone. Of domes the finest, without any comparison, ancient or modern, is that of the Rotunda or Pantheon at Rome (142½ feet internal diameter and 143 feet internal height), erected under Augustus, and still perfect.

DOMESDAY (or Doomsday) **BOOK,** a book containing a survey of all the lands in England, compiled in the reign and by the order of William the Conqueror. The survey was made by commissioners, who collected the information in each district from a sworn jury consisting of sheriffs, lords of manors, presbyters, bailiffs, villeins—all the classes, in short, interested in the matter. The extent, tenure, value, and proprietorship of the land in each district, the state of culture, and in some cases the number of tenants, villeins, serfs, etc., were the matters chiefly recorded. The survey was completed within a year.

DOMESTIC ANIMALS, such as are reared and kept by man, and are to some extent in a tame state; as the dog, cat, ox, sheep, swine, horse, ass, elephant, camel, llama, reindeer, etc.

DOM'ICILE, in law, the place where a person has a home or established residence. Domicile is often an important question in determining the efficacy of legal citations, the validity of marriage, the right of succession to property, etc. For some purposes what is called a temporary domicile is sufficient, but in questions of marriage and succession it is the permanent domicile that determines the decision. A permanent domicile may be constituted by birth, by choice, or by operation of the law. To constitute a domicile by choice both actual residence and the intention to make it the permanent home are required. It is a legal principle that the wife takes the domicile of her husband. As a general rule the old domicile, and especially the domicile of origin, continues till a new one has been acquired.

DOMIN'GO, San, capital of the Dominican Republic (or San Domingo) in the island of Hayti. It lies on the southeast coast, at the mouth of the Ozama, and has a commodious port. It is the oldest European city in the New World, having been founded in 1494 by Bartholomew Columbus. Pop. about 16,000.

DOM'INIC, Saint, the founder of the order of the Dominicans, was born in 1170 at Calahorra, in Old Castile. He early distinguished himself by his zeal for the reform of canonical life and by his success as a missionary among the Mohammedans. Saint Dominic is usually considered the founder of the Inquisition, which is supposed to have originated with his mission to the Albigenses; but his claim is denied, on the ground that two Cistercian monks were appointed inquisitors in 1198.

DOMINICA (dom-i-nē'kȧ), a British West India island. It is about 29 miles in length, north to south, and 12 miles in breadth east to west; area, 186,436 acres. The principal exports consist of sugar, molasses, cocoa, and lime-juice. Dominica was ceded by France to Great Britain in 1763. Roseau is the capital. Pop. 26,841 (including about 300 aboriginal Caribs).

DOMINICAN REPUBLIC, or **SAN DOMINGO,** a republic occupying the eastern portion of the island of Hayti; area, 18,000 sq. miles. It is fertile and exports mahogany, sugar, tobacco, cocoa, etc., but its resources are as yet but little developed. It formerly belonged to Spain, and is the oldest colonial settlement in America. Its inhabitants are chiefly negroes and mulattoes. Capital, San Domingo. Pop. estimated at 504,000. See Hayti.

DOMIN'ICANS, called also predicants, or preaching friars (prædicatores), derived their name from their founder, St. Dominic. At their origin (1216, at Toulouse) they were governed by the rule of St. Augustine, perpetual silence, poverty, and fasting being enjoined upon them; and the principal object of their institution was to preach against heretics. Their distinctive dress consists of a white habit and scapular with a large black mantle, and hence they have been commonly known as Black Friars.

DOM'INO, formerly a dress worn by priests in the winter, which, reaching no lower than the shoulders, served to protect the face and head from the weather. At present it is a masquerade dress worn by gentlemen and ladies, consisting of a long silk mantle with wide sleeves and a masking hood. The name is also given to a half-mask formerly worn on the face by ladies when traveling or at masquerades.

Dominican or black friar.

DOM'INOES, a game played with small flat rectangular pieces of ivory, about twice as long as they are broad. They are marked with spots varying in number. When one player leads by laying down a domino, the next must follow by placing alongside of it another which has the same number of spots on one of its sides. Thus if the first player lays down 6–4, the second may reply with 4–8, or 6–7, etc.; in the former case he must turn in the 4, placing it beside the 4 of the first domino, so that the numbers remaining out will be 6–8; in the latter case he must turn in the 6 to the 6 in like manner, leaving 4–7, to which his opponent must now respond. The player who cannot follow suit loses his turn, and the object of the game is to get rid of all the dominoes in hand, or to hold fewer spots than your opponent when the game is exhausted by neither being able to play.

DOMITIAN, or in full Titus Flavius Domitianus Augustus, Roman emperor, son of Vespasian, and brother of Titus, was born A.D. 51, and in 81 succeeded to

the throne. At first he ruled with a show of moderation and justice, but soon returned to the cruelty and excesses for which his youth had been notorious. He established the most stringent laws against high treason, which enabled almost anything to be construed into this crime. At length a conspiracy, in which his wife, Domitia took part, was formed against him, and he was assassinated in his bed-room A.D. 96.

DOMREMY LA PUCELLE (don-rē-mi lȧ pu-sāl), the birth-place of Joan of Arc,

a small French village, department of the Vosges, 7 miles n. of Neufchâteau. The house is still shown here in which the heroine was born, and in the neighborhood is the monument erected to her memory.

DON, a Spanish title of honor, originally given only to the highest nobility, afterward to all the nobles, and finally used indiscriminately as a title of courtesy. It corresponds with the Portuguese Dom. During the Spanish occupation it was introduced and became naturalized in some parts of Italy, and was particularly applied to the priests.

DONA'TI'S COMET, so called from the Italian astronomer Donati, who first observed it in June, 1858. Next to the comet of 1811 it was the most brilliant that appeared last century. It was nearest the earth on the 10th October, 1858.

DON'EGAL, a maritime county, Ireland, province of Ulster, bounded n. and w. by the Atlantic Ocean; area, 1,197,154 acres, of which about a fifth is under crops. The manufactures are limited, and consist chiefly of linen cloth, woolen stockings, and worked muslin. The fisheries are extensive and valuable, and form the chief employment of the inhabitants of the coast and islands. Grain butter, and eggs are exported. The minerals include marble, lead, copper, etc., but are not wrought to advantage. Pop. 173,625. — Donegal, the county town, is a small seaport on the bay of the same name, at the mouth of the river Esk. Pop. 1323.

DONELSON, Andrew Jackson, an American diplomat, born in Tennessee in 1800, died 1871. He was private secretary to Jackson in 1829, and subsequently served as minister to Prussia and the federal German government. He took no part in the civil war.

DON'GOLA, a district of Upper Nubia, extending on both sides of the Nile from about lat. 18° to lat. 20° n. After having belonged to Egypt the rebellion under the Mahdi caused its evacuation by the Egyptian government, leaving it in an unsettled state; but under the Anglo-Egyptian authorities it has again been occupied. Its chief products are dates, cotton, indigo, and maize. The population is a mixture of Arabs and indigenous Nubians. Its chief town is New Dongola, on the Nile. Pop. 6000.

DONIZET'TI, Gaetano, Italian composer, born in 1798, at Bergamo. In 1830 appeared his Anna Bolena, which first, along with Lucrezia Borgia and Lucia di Lammermoor—the latter his masterpiece—acquired for him a European fame. Donizetti removed in 1840 to Paris, bringing with him three new operas, Les Martyrs, La Favorita, and La Fille du Régiment, of which the last two are among his most popular productions. He died 8th April, 1848. He had written as many as sixty-four operas.

DON JUAN (*h*u-ân'), the hero of a Spanish legend which seems to have had some historical basis in the history of a member of the noble family of Tenorio at Seville. According to the legend Don Juan was a libertine of the most reckless character. An attempt to seduce the daughter of a governor of Seville brought the indignant father and the profligate don into deadly conflict, in which the former was slain. Don Juan afterward, in a spirit of wild mockery, goes to the grave of the murdered man and invites the statue of him erected there to a revel. To the terror of Don Juan the "stony guest" actually appears at the table to bear him away to the infernal world. The legend has furnished the subject for many dramas and operas. The most famous of the latter is Mozart's Don Giovanni, which has made the story familiar to everybody. The Don Juan of Byron bears no relation to the old story but in name and in the libertine character of the hero.

DONKEY-ENGINE, a small engine used in various operations where no great power is required. Thus a donkey-engine is often stationed on the deck of a ship to work a crane for loading and unloading.

DONNYBROOK, a village, Ireland, now mostly in the parliamentary borough of Dublin. Its famous fair, which seldom passed off without riot and bloodshed, was abolished in 1855.

DON QUIXOTE (kē-*h*ō'tā), the title of a famous romance by Cervantes. The name of the hero, Don Quixote, is used as a synonym for foolish knight-errantry or extravagant generosity.

DOOMSDAY BOOK. See Domesday Book.

DORCAS SOCIETY (from Dorcas mentioned in Acts ix.), an association generally composed of ladies for supplying clothes to the poor. Frequently the members of the society meet at stated times and work in common.

DORDOGNE (dor-dony), a department of France, which includes the greater part of the ancient province of Périgord, and small portions of Limousin, Angoumois, and Saintonge. Area, 3544 sq. miles, of which about a third is fit for the plow. The climate is mild but somewhat changeable. Pop. 492,205.

DORE (dō-rā), Paul Gustave, a prolific French draftsman and painter, born at Strasbourg Jan. 6, 1833. He studied at Paris, contributing, when only sixteen years of age, comic sketches to the Journal Pour Rire. He distinguished himself greatly as an illustrator of books. His illustrations of Rabelais, of Perrault's Tales, Sue's Wandering Jew, Dante's Divina Commedia, and Cervantes' Don Quixote, displayed great fertility of invention, and the fine fantasy of his landscapes and the dramatic effectiveness of his groups acquired for him a European reputation. His illustrations of the Bible, of Ariosto's Orlando Furioso, and Milton's Paradise Lost, are also of high excellence. As a painter he has grandeur of conception and a bold expressive style. Among his chief works are Christ leaving the Prætorium, Paolo and Francesca di Rimini, The Flight into Egypt, Mont Blanc, etc. In later years Doré also won fame as a sculptor. He died 23d June, 1883.

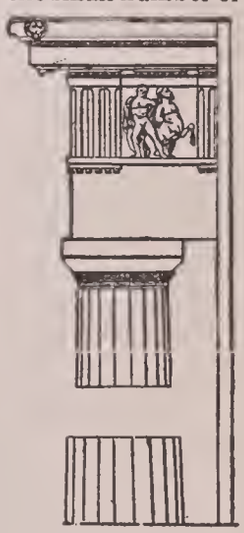
DORIANS, one of the four great branches of the Greek nation who migrated from Thessaly southward, settling for a time in the mountainous district of Doris in Northern Greece and finally in Peloponnesus. Their migration to the latter was said to have taken place in B.C. 1104; and as among their leaders were certain descendants of Hercules (or Herakles), it was known as the return of the Heraclidæ. The Dorians ruled in Sparta with great renown as a strong and warlike people, though less cultivated than the other Grecks in arts and letters. Their laws were severe and rigid, as typified in the codes of the great Doric legislators Minos and Lycurgus. (See Sparta.)—The Doric dialect was characterized by its broadness and hardness, yet on account of its venerable and antique style was often used in solemn odes and choruses.

DORIC ORDER, in architecture, is the oldest, strongest, and simplest of the three Grecian orders, and the one that is best represented among the remains of ancient Greek architecture. The Doric

Doric entablature.

e, entablature; *a*, epistyle or architrave; *b*, frieze; *c*, cornice. (From Archæol. Inst. Report on Assos Expedition.

column is distinguished by its want of a base (in the more ancient examples, at least), by the small number of its flutings



Grecian Doric order.

and by its massive proportions, the true Grecian Doric having the height of its pillars six times that of the diameter. The capital was small and simple, and the architrave, frieze, and cornice were rather plain and massive.

DORMANT STATE, a state of torpidity in which certain animals pass a portion of the year. In cold and temperate climates this period of long sleep takes place during the winter months, and is properly called hibernation. It commences when the food of the animals begins to get scarce, continues for a longer or shorter period, and is deeper or lighter according to the habits and constitution of the animal. Bats, bears, some animals of the rodent order, such

as the porcupine, the dormouse, the squirrel, etc., all the animals belonging to the classes of Amphibia and Reptilia, such as tortoises, lizards, snakes, frogs, etc., and many species of molluscs and insects, hibernate more or less completely, retiring to suitable places of concealment—the bat to dark caves, the hedgehog to fern-brakes, snakes to holes in trees, etc. During hibernation there is a great decrease of heat in the bodies of the animals, the temperature sometimes sinking to 40° or even 20° Fahr., or in general to a point a little above that of the surrounding atmosphere. The respiration as well as the pulsation of the heart is exceedingly slow, and the irritability of the animal often so low that in some cases it can be awakened only by strong electric shocks. With frogs and amphibious reptiles the dormant state is very common, and if the temperature is kept low by artificial means they may remain dormant for years. The term æstivation has been used to describe a similar condition into which certain animals, such as serpents and crocodiles, in tropical countries pass during the hottest months of the year.

DORMER WINDOWS are windows inserted in the inclined plane of a sloping roof, on a frame rising vertically above the rafters.

DORMOUSE, a genus of mammiferous quadrupeds, of the order Rodentia. These little animals, which appear to be intermediate between the squirrels and the mice, inhabit temperate and warm countries, and subsist entirely on vegetable food. Their pace is a kind of leap, but they have not the activity of squirrels. Whilst feeding they sit upright and carry the food to their mouth with their paws. The dormice pass the winter in a lethargic or torpid state, reviving only for a short time on a warm sunny day, when they take a little of their hoarded stores and then relapse into the dormant state.

D'ORSAY, Alfred, Count, a dilettante artist and man of fashion, born at Paris 1798, died 1852. When a young man he visited England, and became acquainted with Byron and other literary and fashionable celebrities. He married a daughter of the Earl of Blessington, but after the earl's death a separation took place, and D'Orsay became an inmate of Gore House, which the Countess of Blessington had made the center of a famous literary coterie. A zealous Bonapartist, he followed Prince Louis Napoleon to Paris in 1849, whose favor he enjoyed till his death.

DORSET, Dorsetshire, a maritime county in the south of England, having on the south the English Channel; area, 627,265 acres, over 490,000 being under crop. The general surface of the county is undulating; its principal elevations being chalk hills known as the North and South Downs, upon which immense flocks of sheep are pastured. The principal manufactures are those of flax, canvas, duck, etc., also silk and woolens. The principal rivers are the Stour, the Frome, and the Piddle. Dorchester is the county town. Other towns are Bridport, Poole, and Weymouth. Pop. 202,962.

DORSET, Earls of. See Sackville.

DORT'MUND, a city of Prussia, province of Westphalia, on the Emscher, 47 miles n.n.e. of Cologne, starting-point of an important canal to the lower Ems. It was once a free imperial Hanseatic town, and the seat of the chief tribunal of the Vehme. Pop. 142,733.

DORY, a fish belonging to the mackerel family, celebrated for the delicacy of its flesh. It seldom exceeds 18 inches in length, and is yellowish-green in color with a blackish spot on each side, which,

Dory.

according to an old superstition, is the mark of St. Peter's fore-finger and thumb. The dory is found on the Atlantic shores of Europe and in the Mediterranean.

DOUAI (dö-ā), or **DOUAY,** a town, France, department Nord, on the Scarpe, 18 miles south of Lille. It is one of the oldest towns in France, of which it became part by the Treaty of Utrecht. It is strongly fortified, has a fine townhouse, several handsome churches, an academy of arts and law, a lyceum, museum and public library, Benedictine college, hospital, etc.; a cannon foundry, linen manufactories, machine-works, tanneries, etc. There was long here a college for British Roman Catholic priests, the most celebrated of its kind. Pop. 30,030.

DOUAI BIBLE, the English translation of the Bible used among English-speaking R. Catholics, and executed by divines connected with the English College at Douai. The New Testament was published in 1582 at Rheims, the Old in 1609—10 at Douai, the translation being based on the vulgate. Various revisions have since materially altered it.

DOUBLE CONSCIOUSNESS, an alleged morbid "state of mind," in which the same person at different times appears to have a different personality. It is seriously discussed by psychologists, who compare it with hypnosis, and it is probably due to incomplete coordination in the associational region of the cerebral cortex.

DOUBLE-EAGLE, an American gold coin of the value of twenty dollars, so called because double the value of the coin called the eagle.

DOUBLE-ENTRY. See Book-keeping.

DOUBLE-INSURANCE, the effecting of two insurances upon the same goods. In marine insurance it is lawful for a shipper to insure his goods twice, but only to give an additional security in the event of the failure of the first underwriters. In the event of a loss it is ultimately divided among the underwriters in the ratio of the risks they have taken.

DOUBLE-STANDARD OF MONETARY VALUE. See Currency, Bimetallism.

DOUBLE-STARS, or **BINARY STARS,** stars which are so close together that they appear as one to the naked eye, but are seen to be double when viewed through a telescope. One of these stars may revolve about the other, or both may revolve round a common center. See Stars.

DOUBLET, a close-fitting garment, covering the body from the neck to a little below the waist. It was introduced from France into England in the

1, Doublet, time of Edward IV. 2, 3, Doublets, time of Elizabeth. 4, Doublet, time of Charles I.

14th century, and was worn by both sexes and all ranks until the time of Charles II., when it was superseded by the vest and waistcoat. The garment got its name from being originally lined or wadded for defense.

DOUBS (dö), a department of France, having Switzerland on its eastern frontier. Its surface is traversed by four chains of the Jura. The temperature is variable, and the climate somewhat rigorous. About a third of the land is arable, but much the greater part is covered with forests. Maize, potatoes, hemp, flax, are the principal crops. Much dairy produce is made into Gruyère cheese. The minerals include iron, lead, and marble. Pop. 310,963.

DOUCHE (dösh), a jet or current of water or vapor directed upon some part of the body; employed in bathing establishments. When water is applied it is called the liquid douche, and when a current of vapor the vapor douche.

DOUGHFACE, a name applied, before and during the civil war, to any resident of the North who favored the slave owners of the South. The application of the name is not clear.

DOUGLAS (dug'las), a family distinguished in the annals of Scotland. Their origin is unknown. They were already territorial magnates at the time when Bruce and Baliol were competitors for the crown. As their estates lay on the borders they early became guardians of the kingdom against the encroachments of the English, and acquired in this way power, habits, and experience

which frequently made them formidable to the crown.

DOUGLAS, Stephen Arnold, American statesman, born in Vermont 1813, died 1861. Having gone to Jacksonville, Ill., be became an attorney, was appointed attorney-general for the state, and in 1843 was elected a member of the U.

Stephen A. Douglas.

States house of representatives. In 1847 he was elected to the senate, and by re-election was a member of this body till his death. He was especially prominent in connection with the question at to the extension of slavery into new states and territories, which he maintained was a matter to be settled by the people of the respective states or territories, and not by congress. He was a presidential candidate in 1860, when Lincoln was elected.

DOUGLASS, Frederick, American lecturer and journalist, was the son of a negro slave, and was born at Tuckahoe in Maryland, about 1817. Although his father was a white man, he was, according to the law, reared as a slave. In 1832 he was purchased by a Baltimore ship-builder, but made his escape in 1838. As he had taught himself to read and write, and showed talent as an orator, he was employed by the anti-slavery society as one of their lecturers. In 1845 he published his autobiography, and afterward made a successful lecturing tour in England. In 1870 he started a journal entitled the The New National Era; in 1871 he was appointed secretary of the commission to Santo Domingo; in 1872, presidential elector; in 1877 marshal for the district of Columbia, then commissioner of deeds for that district, and in 1889 United States minister to Hayti. He died in 1895.

DOUM PALM (döm), a palm-tree. It is remarkable, like the other species of the genus, for having a repeatedly-branched stem. Each branch terminates in a tuft of large fan-shaped leaves. The fruit is about the size of an apple; it has a fibrous mealy rind, which tastes like gingerbread (whence the name gingerbread tree sometimes applied to this palm), and is eaten by the poorer inhabitants of Upper Egypt, where it grows. An infusion of the rind is also used as a cooling beverage in fevers. The seed is horny, and is made into small ornaments. Ropes are made of the fibers of the leaf-stalks.

DOVE. See Turtle-dove and Pigeon.

DOVER, a city in New Hampshire. It is situated on both sides of the Cochecho, which has here a fall of over 30 feet, affording abundant water-power for the large iron and cotton manufactories. Pop. 13,214.

DO'VER, a mun. and parl. borough of England, county Kent, 67 miles south-east of London. It is an important railway terminus, and as a port for mail and packet service with the Continent has a large passenger traffic. Pop. 41,782.

Doum palm.

DOVER, Straits of, the narrow channel between Dover and Calais which separates Great Britain from the French coast. At the narrowest part it is only 21 miles wide. The depth of the channel at a medium in the highest spring-tides is about 25 fathoms. On both the French and English sides the chalky cliffs show a correspondency of strata which leaves no room for doubt that they were once united, although this is known otherwise.

DOVER'S POWDER, a preparation frequently used in medical practice to produce perspiration. It consists of 1 grain of opium, 1 of ipecacuanha, and 8 of sulphate of potash in every 10 grains, which constitute a full dose. In preparing it the ingredients must be thoroughly mixed.

DOVE-TAILING, in carpentry, is the fastening boards together by letting one piece in the form of a dove-tail into a corresponding cavity in another. The dove-tail is the strongest kind of jointing.

DOW, Neal, an American temperance advocate, born in Maine in 1804, died in 1897. He fought in the civil war on the Union side, rose to be brigadier-general, was a prisoner in Libby prison and in 1880 was prohibition candidate for president of the United States. His whole life long he consistently worked for total abstinence.

DOWER, in English law, is the right which a wife (not being an alien) has in the lands and tenements of which her husband dies possessed. By common law this right amounts to one-third of his estate during her life; by local custom it is frequently greater.

DOWN, a county of Ireland, in Ulster, bounded on the north by Belfast Lough and on the east by the Irish Sea; area, 610,730 acres, of which over five-sixths are productive. The principal manufactures are linen and muslin. The fisheries on the coast, principally cod, haddock, and herring, are considerable. the county town is Downpatrick. Pop. 289,335.

DOWNING, Andrew Jackson, an American horticulturist, born in New York in 1815, died in 1852. He introduced into this country the English method of landscape gardening, designed the garden of the capitol at Washington, and other government garden works.

DOXOL'OGY, a set form of words giving glory to God, and especially a name given to two short hymns distinguished by the title of greater (Glory be to God on high, etc.) and lesser (Glory be to the Father, etc.). Both the doxologies have a place in the Church of England liturgy, the latter being repeated after every psalm, and the former used in the communion service.

DOYLE, Sir Arthur Conan, English novelist, born at Edinburgh, 1859, studied medicine, and for some years practiced, but gave up the profession for that of literature. Among his books are Micah Clarke; The Sign of Four; The White Company; The Adventures of Sherlock Holmes, etc.

DRACHMA (drak'ma), the unit of weight and of money among the ancient Greeks. It was the principal Greek coin, was made of silver and was worth (the Attic drachma) about 20 cents. As a weight among the Greeks it was about 2 dwt. 7 grains troy.

DRACO, a legislator of Athens, about 620 B.C., whose name has become proverbial as an inexorable and bloodthirsty lawgiver, and whose laws were said to have been written in blood, not ink.

DRACO, the Dragon, a constellation of the northern hemisphere, containing, according to Flamsteed, eighty stars. The star Draconis is celebrated as the one used in determining the coefficient of aberration of the fixed stars.

DRAFT, or **DRAUGHT,** a bill drawn by one person on another. Also a rough copy of any document intended to be afterward transcribed.

DRAG, (1) a long coach or carriage, generally uncovered and seated round the sides. (2) An apparatus for retarding or stopping the rotation of one wheel or of several wheels, in carriages especially. (3) An apparatus, consisting of a frame of iron with a bag-net attached, used to recover articles lost in the water.

DRAG-NET, a net drawn along the bottom of a river or pond to catch fish. The use of drag-nets is usually prohibited in rivers where fish breed, as it takes all indiscriminately.

DRAGO DOCTRINE, so called from Argentine, minister of foreign affairs of that name, who in 1906 declared the debts of one nation should not be forcibly collected by army and navy of another nation, but left to the courts.

DRAG'ON, a fabulous monster, the stories regarding which reach back almost as far as history. His form is described as generally resembling that of a winged and two-legged serpent, the body covered with scales, the head crested, and the mouth spouting fire. The immediate source of the mediæval conception is probably the Scriptures, modi-

fied by accounts brought home by the crusaders of the crocodiles in Egypt.

DRAGON, or **DRAGON-LIZARD,** a name for several species of lizards inhabiting Asia, Africa, and South America. The common flying lizard, the best

The dragon of fable.

type of the genus, is about 10 or 12 inches in length, the tail being extremely long in proportion to the body. The sides are furnished with peculiar extensions of the skin, forming a kind of wings, which help to support it in the air when it springs from branch to branch. Its food consists almost exclusively of insects.

DRAGON-FLY, a family of neuropterous insects. They have a large head, large eyes, and strong horny mandibles. They are beautiful in form and color, and are of very powerful flight. They live on

Dragon-fly.

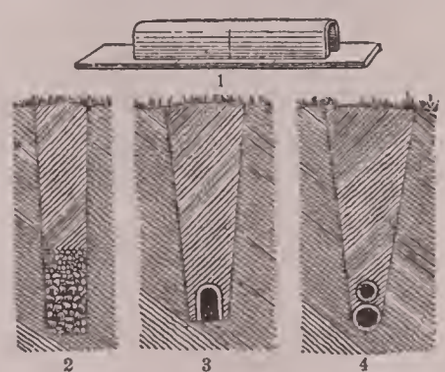
insects, and are remarkable for their voracity. The dragon-fly deposits its eggs in the water, where the larvæ and pupæ live on aquatic insects. The larval stage lasts for a year. The family is of very wide distribution.

DRAGON'S BLOOD, a resinous juice, usually obtained by incision from various tropical plants. It differs in composition, and is often much adulterated. It is opaque, of a reddish-brown color, brittle, and has a smooth shining conchoidal fracture. It is soluble in alcohol and oil, but scarcely so in water. It is used for coloring varnishes, staining marble, leather, and wood, for tooth tinctures, etc.

DRAGON-TREE, a tree-like lilaceous plant, with a stem simple or divided at top, and in old age often much branched. It is a native of the Canaries, and yields the resin known as dragon's blood. It is often grown in stoves and greenhouses.

DRAGOON', a kind of mounted soldier, so called originally from his musket (dragon) having on the muzzle of it the head of a dragon. At one time dragoons served both as mounted and foot soldiers, but now only as the former.

DRAINAGE, in agriculture, a method of improving the soil by withdrawing the water from it by means of channels that are generally covered over. The successful practice of draining in a great measure depends on a proper knowledge of the superficial strata, of their situation, relative degrees of porosity, etc. Some strata allow water to pass through them, while others more impervious force it to run or filtrate along their surfaces till it reaches more level ground below. In general where the grounds are in a great measure flat and the soils of materials which retain the excess of

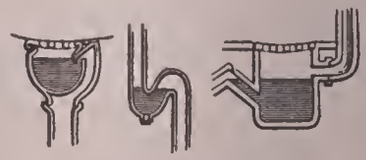


1, Horse-shoe tile with sole. Sections of drain —2, Stone drain. 3, Drain with horse-shoe tiles. 4, Drain with pipe-tiles.

moisture, they require artificial means of drainage to render them capable of yielding good crops whether of grain or grass. The wetness of land which makes it inferior for agricultural purposes, may appear not only as surface-water but as water which flows through the lower strata, and to draw off these there are the two distinct operations of surface-draining and under-draining. The rudest form of open drains are the deep furrows lying between high-backed ridges, and meant to carry off the surplus water after the soil is completely saturated, but in doing so they generally carry off also much of the best of the soil and of the manure which has been spread upon it. The ordinary ditch is a common form of water-course useful in certain cases, as in hill pastures. But covered drains at a depth of 4 feet or so are the common forms in draining agricultural lands. They are generally either stone-drains or tile-drains. Stone-drains are either formed on the plan of open culverts of various forms, or of small stones in sufficient quantity to permit a free and speedy filtration of the water through them. The box-drain, for instance, is formed of flat stones neatly arranged in the bottom of the trench, the whole forming an open tube. In tile-drains, tiles or pipes of burnt clay are used for forming the conduits. They possess all the qualities which are required in the formation of drains, affording a free ingress to water, while they effectually exclude vermin, earth, and other injurious substances. Drainage tiles and pipes have been made in a great variety of forms, the earliest of which, since the introduction of thorough draining, was the horse-shoe tile, so called from its shape. These should always rest on soles, or flats of burned clay. Pipe tiles, which combine the sole and cover in one piece, have been made of various shapes, but the best form appears to be the cylinder. An important department of draining is the draining off of the waters which are the sources of springs. Sometimes the judicious application of a few simple drains, made to communicate with the watery layers, will often dry swamps of great extent, where large sums of money, expended in forming open drains in the swamp itself, would leave it but little improved. In the laying out of drains the first point to be determined is the place of outfall, which should always afford a free and clear outlet to the drains, and must necessarily be at the lowest point of the land to be drained. The next point to be determined is the position of the minor drains; in the laying out of which the surface of each field must be regarded as being made up of one or more planes, as the case may be, for each of which the drains should be laid out separately. Level lines are to be set out a little below the upper edge of each of these planes, and the drains must then be made to cross these lines at right angles. By this means the drains will run in the line of the greatest slope, no matter how distorted the surface of the field may be. All the minor drains should be made to discharge into mains or submains, and not directly into an open ditch or water-course. As a general rule there should be a main to receive the waters of the minor drains from every 5 acres. The advantages of drainage are obvious. In the first place it allows the soil to be brought into a more suitable condition for the growth of plants, aiding in producing the finely-divided and porous state by which the roots and rootlets can spread themselves at will in order to obtain the needed supplies of food, air, and moisture. It also allows the sun's rays to produce their full effect on the soil and plants without being robbed of great part of it by the stagnant water.

DRAINAGE TUBES are used in surgery to effect a discharge of matter from an abscess or other collection of matter when a free incision cannot be safely or conveniently made. They are usually made of india-rubber or caoutchouc, and are introduced into the abscess or wound so that one end is in contact with the seat of discharge, while the other reaches to the surface of the skin.

DRAIN-TRAP, a contrivance to prevent the escape of foul air from drains, but to allow the passage of water into them. They are of various forms. In



Drain-trap.

the traps represented above it will be seen that there must always be certain quantity of water maintained to bar the way against the escape of the gas from

the drain or sewer. When additional liquid is conveyed to the trap there is of course an overflow into the drain. In the left-hand figure the gas is prevented from escaping by a metal plate thrown obliquely over the drain mouth and dipping into the water in the vessel beyond it.

DRAKE, Sir Francis, an English navigator, born at Tavistock, in Devonshire, in 1539. He joined Sir John Hawkins in his last expedition against the Spaniards (1567). Having gathered a number of adventurers round him he contrived to fit out a vessel in which he made two successful cruises to the West Indies in 1570 and 1571. Next year, with two small ships, he again sailed for the Spanish Main, captured the cities of Nombre de Dios and Vera Cruz, and took a rich booty which he brought safely home. In 1577 Drake made another expedition to the Spanish Main, having this time command of five ships. On this the most famous of his voyages Drake passed the Straits of Magellan, plundered all along the coast of Chili and Peru, sacked several ports, and captured a galleon laden with silver, gold, jewels, etc., to the value of perhaps $1,000,000. He then ran north as far as 48° n. lat., seeking a passage to the Atlantic, but was compelled to return to Port San Francisco on account of the cold. He then steered for the Moluccas, and holding straight across the Indian Ocean doubled the Cape of Good Hope, and arrived at Plymouth 3d Nov., 1580, being thus the first of the English circumnavigators. In 1593 he represented Plymouth in parliament. His later expeditions, that in 1595 against the Spanish West Indies and that to Panama, were not so successful, and his death, which took place in 1596 at sea off Porto Bello, was hastened by disappointment.

Sir Francis Drake.

DRAMA, a class of writings which almost entirely consist of dialogue, persons being represented as acting and speaking, and the pieces being usually intended to be acted on a stage by parties assuming the characters of the respective persons. Its two great branches are tragedy and comedy, the former, roughly speaking, melancholy in character, the latter cheerful. The origin of the drama must be sought for in the love of imitation, and dramatic performances of some kind are to be met with probably among all nations. Dramatic compositions are found in the Old Testament, for example, in Job and the Song of Solomon; and ancient India and China both developed a dramatic literature of their own. The European drama had its origin in Greece. Both forms, tragic and comic, took their rise in the celebrations of the Greek festivals of Dionysius (Bacchus), at which hymns and chants were sung by choruses in honor of the god, and the chorus continued to be a prominent feature of the old Greek drama. Greek comedy commenced about 580–560 B.C., with Susarion, but it was long in attaining regular form. Of the old Greek comedy the chief representatives were Cratinus, Eupolis, Pherecrates, and Aristophanes—the last the greatest. The invention of tragedy is generally ascribed to Thespis about 530 B.C., who was followed by Phrynichus. But the true creator of tragedy was Æschylus, in whose works and those of Sophocles and Euripides it found its most perfect expression.

In most modern European countries the regular drama took its rise in the mysteries, miracle-plays, and moralities of the middle ages. In Italy, however, it began with a reproduction in Latin of classical models. The earliest tragedy in Italian is Trissino's Sofonisba (1502). Regular comedies in Italian were written by Ariosto, Aretino, Macchiavelli, and others; and to the same period (15th and 16th centuries) belongs the Italian Pastoral Drama, which sprung from the ancient idylls, and aimed at a fanciful delineation of Arcadian and mythological scenes. Among the pastoral dramatists of this period are Poliziano, Tasso and Guarini. The pastorals gave birth to the opera, early masters of which, so far as it may be included in the poetic drama, are Zeno and Metastasio. The Italian drama waned in the 17th century, but in the 18th genuine comedy and classic tragedy were restored, the former by Goldoni, the latter by Alfieri. Monti, Manzoni, and Niccolini are among the later writers of tragedy.

The other European nations cultivated the dramatic art much later than the Italians. The English and Spaniards devoted their attention to it almost at the same time; the former reaching their acme in Shakespeare, the latter in Lope de Vega and Calderon. The history of the English theater and the drama is naturally divided into two parts, the first of which begins with the reign of Elizabeth and ends with the reign of Charles I. With Charles II. the drama reappeared, and exhibited a licentiousness hardly equalled by that of any other Christian nation. During the 19th century many writers have been conspicuous by their dramas. Among the chief of these may be noted Byron, Coleridge, Landor, Shelley, Maturin, Talfourd, Milman, Sir Henry Taylor, the first Lord Lytton, Knowles, R. H. Horne, Arnold, Browning, Swinburne, and Tennyson. Among other 19th century writers for the stage, who, however, may be called playwrights rather than dramatists, may be named, Douglas Jerrold, Tom Taylor, Charles Reade, Thomas Robertson, W. G. Wills, Henry Byron, Robert Buchanan, Dion Boucicault, W. S. Gilbert, etc.

The French drama was in a miserable state before Corneille (1606–84), who indeed is looked on as the founder of the drama in France. Racine, Molière, Voltaire, and in later times Hugo, are some of the other distinguished French dramatists. Since about 1820 a new dramatic school has been formed in France, which, departing from the ancient strictness of what is called the classic, approaches more and more to the German or British, or what is called the romantic school.

The German drama is of later birth than any we have mentioned, and for a long time the Germans contented themselves with translations and adaptations from the French. Lessing was the first who, by word and deed, broke the French sway (1755), and he was succeeded by Schiller and Goethe, who rank as the greatest of the more modern dramatists. Prominent names in the German drama are Kotzebue, Körner, Schlegel, Tieck, Brentano, Grillparzer, Hebbel, Ludwig, Gutzkow, Freytag, Laube, Von Moser, etc. The Dutch drama begins with the classical tragedies of Koster in the beginning of the 17th century, and reached its highest in Vondel (1587–1659). Holberg, Heiberg, Oehlenschläger, Ibsen, and Björnson are the chief names connected with the Scandinavian drama.

The American drama is on the same order as the English, and although no great dramatists have been developed in the U. States many plays of power have been written by American authors. Among them may be mentioned The Contrast, by Royall Tyler; The Prince of Parthia, by Godfrey; Brutus, or the Fall of Tarquin, by John Howard Payne; Metamora, by John A. Stone; and The Gladiator, by R. N. Bird. More recently a number of fairly good plays have been written, but the U. States has not produced a classic play since those above mentioned.

DRAPER, John William, an American historian, chemist, and philosopher, born in England in 1811, died in 1882. He came to the U. States as a boy and was early a teacher in Sidney College, Va. He made important contributions to the science of physical chemistry, but is popularly known for his two works The History of the Intellectual Development of Europe (1863) and The History of the Conflict Between Religion and Science (1874).

DRAPERY, the clothes or hangings with which any object is draped or hung; specifically in sculpture and painting, the representation of the clothing or dress of human figures.

DRAUGHT, the depth of a body of water necessary to float a ship; or the depth a ship sinks in water, especially when laden.

DRAUGHTS, a game resembling chess played on a board divided into sixty-four checkered squares. Each of the two players is provided with twelve pieces or "men" placed on every alternate square at each end of the board. The men are moved forward diagonally to the right or left one square at a time, the object of each player being to capture all his opponent's men, or to hem them in so that they cannot move. A piece can be captured only when the square on the diagonal line behind it is unoccupied. When a player succeeds in

moving a piece to the further end of the board (the crown-head), that piece becomes a king, and has the power of moving or capturing diagonally backward or forward. When it so happens that neither of the players has sufficient advantage in force or position to enable him to win, the game is drawn. Checkers is the common American name of the game.

DRAWBACK, usually a certain amount of duties or customs dues paid back or remitted to an importer when he exports goods that he has previously imported and paid duty on, as, for instance, tobacco, etc.; or a certain amount of excise paid back or allowed on the exportation of home manufactures.

DRAWBRIDGE, a bridge with a lifting floor, such as were formerly used for crossing the ditches of fortresses, or any movable bridge over a navigable channel where the height of the roadway is insufficient to allow vessels to pass underneath. Modern drawbridges across rivers, canals, the entrances of docks, etc., are generally made to open horizontally, and the movable portion is called a bascule, balance, or lifting bridge, a turning, swivel, or swing bridge, or a rolling bridge, in accordance with the mode in which it is made to open. Swing-bridges are usually divided into two parts meeting in the middle, and each moved on pivots on the opposite sides of the channel, or they may move as a whole on a pivot in the middle of the channel. Rolling bridges are suspended from a structure high above the water, and are propelled backward and forward by means of rollers.

DRAWING is the art of representing upon a flat surface the forms of objects, and their positions and relations to each other. The idea of nearness or distance is given by the aid of perspective, foreshortening, and gradation. The term drawing, in its strict sense, is only applicable to the representing of the forms of objects in outline, with the shading necessary to develop roundness or modeling. In art, however, the term has a wider significance. Highly-finished paintings in water-color are called drawings, as are also sketches or studies in oils. Drawing, in its restricted sense, may be divided into these kinds: (1) pen drawing; (2) chalk drawing, which may include lead-pencil drawings; (3) crayon drawing; (4) drawing shaded with the brush or hair-pencil; (5) architectural or mechanical drawing. Pen drawings are often confined to pure outlines; an appearance of relief or projection being given by thickening or doubling the lines on the shadow side. Finished pen drawings have all the shading produced by combinations of lines. Chalk drawings (including lead-pencil drawings) are most suited for beginners, as errors can be easily corrected. Black, red and white chalks are used. When the chalk is powdered and rubbed in with a stump, large masses and broad effects can be produced with much rapidity. A combination of hatching and stumping is generally preferable to adhering exclusively to either mode. Crayon drawings are those in which the true colors of the objects represented are more or less completely wrought out with different colored crayons. Drawings shaded with the brush are outlined with the pencil or pen, the shading being laid on or washed in with the brush in tints of India ink, sepia, or color. Architectural and mechanical drawings are those in which the proportions of a building, machine, etc., are accurately set out for the guidance of the constructor: objects are in general delineated by geometric or orthographic projection.

DREAMS, trains of ideas which present themselves to the mind during sleep. The principal feature of the state of dreaming is the absence of voluntary control over the current of thought, so that the principle of suggestion has unlimited sway. There is usually an utter want of coherency in the images that appear before the mental eye, but this want excites no surprise in the dreamer. Occasionally, however, intellectual efforts are made during sleep which would be difficult to surpass in the waking state. It is said that Condillac often brought to a conclusion in his dreams reasonings on which he had been employed during the day; and that Franklin believed that he had been often instructed in his dreams concerning the issue of events which at that time occupied his mind. Coleridge composed from 200 to 300 lines during a dream; the beautiful fragment of Kubla Khan, which was all he got committed to paper when he awoke, remains a specimen of that dream-poem. Dreams are subjective phenomena dependent on natural causes. They generally take their rise and character from external bodily impressions, or from something in the preceding state of body or mind. They are, therefore, retrospective and resultant instead of being prospective or prophetic. The latter opinion has, however, prevailed in all ages and among all nations; and hence the common practice of divination or prophesying by dreams, that is, interpreting them as presages of coming events. Some authorities declare that all our dreams take place when we are in process of going to sleep or becoming awake, and that during deep sleep the mind is totally inactive. This is denied by the majority of philosophers, and with apparent reason.

DREDGING, a term applied to the operation of removing mud, silt, and other deposits from the bottom of harbors, canals, rivers, docks, etc. The steam dredging-machine now in common use has a succession of strong iron buckets on an endless chain, which traverses on a frame whose lower end is vertically adjustable so as to regulate the depth at which it works. It is worked by steam, and the buckets tear up the matter at the bottom, raise it, and discharge it into punts or hoppers stationed close to the dredging vessel. Dredging is also the operation of dragging the bottom of the sea in order to bring up oysters, or to procure shells, plants, and other objects for scientific observation. The oyster dredge is a light iron frame with a scraper like a narrow hoe on one side, and a suspending apparatus on the other. To the frame is attached a bag made of some kind of netting to receive the oysters. The dredges used by naturalists are mostly modifications of or somewhat similar to the oyster dredge. Scientific dredging has of late assumed a high importance as making us acquainted with the life of deep-sea areas.

DRED SCOTT CASE, a celebrated case decided by the United States Supreme Court in 1857. Scott was the slave of a Missouri owner who brought him into Illinois and later into Minnesota. There he was permitted to marry and raise a family On his return to Missouri he sued for freedom on the ground that his residence in Illinois and Minnesota (which were free soil) had enfranchised him. All the lower courts decided against him and so did the supreme court which held that negroes descended from negro slaves had no standing in the courts. In his decision Justice Taney used the oft-quoted words, "the negroes had no rights which the white man was bound to respect."

DRENTHE (dren'te), a province, Holland, bounded by Hanover, Overijssel, Friesland, and Groningen; area, 948 sq miles. Drenthe is remarkable for the great number of so-called "giants" graves' or barrows scattered over the country. Its capital is Assen. Pop. 125,792.

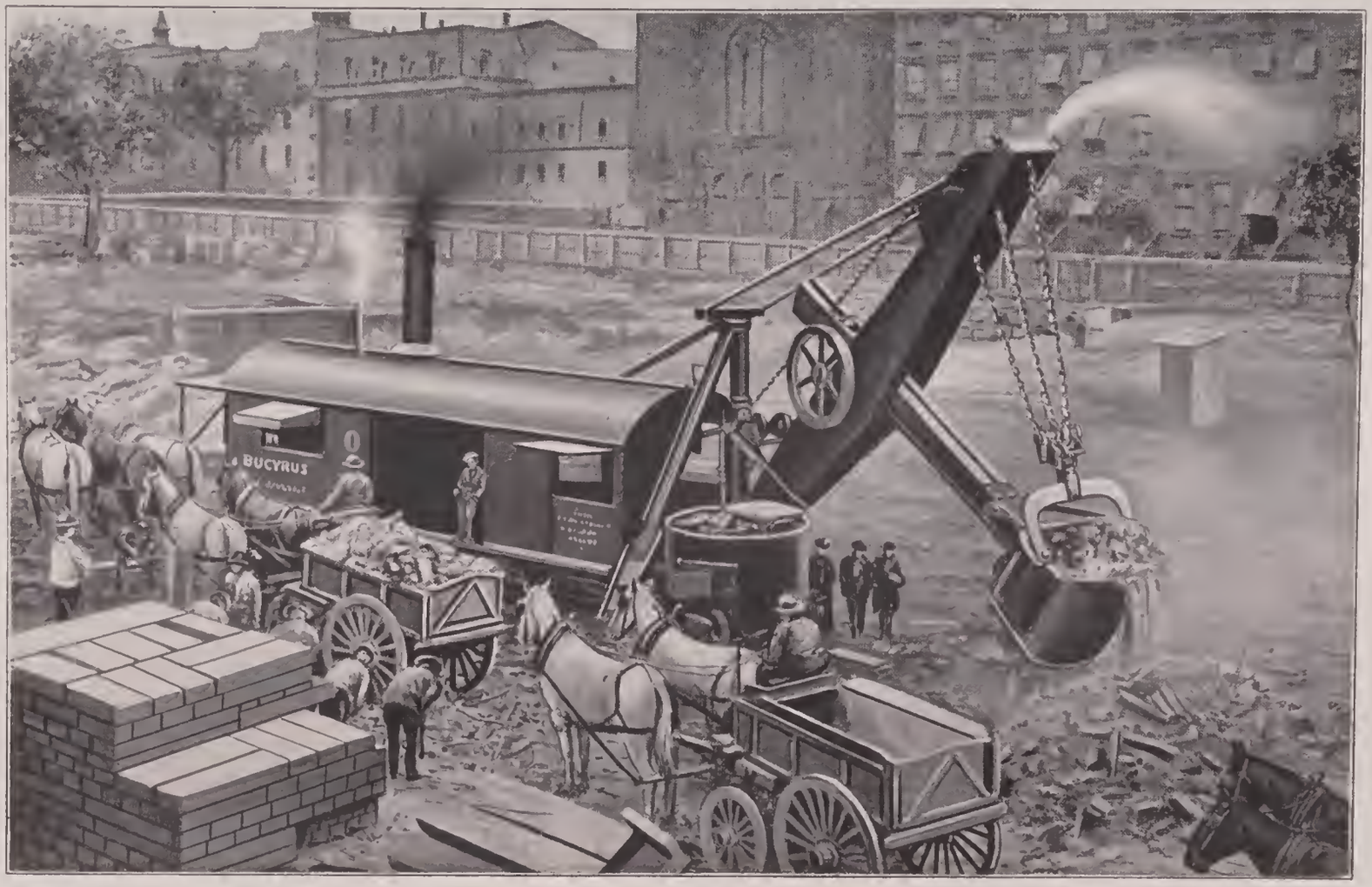
Dresden—The old bridge, Court church, and church of Our Lady.

DRES'DEN, the capital of the kingdom of Saxony, is situated in a beautiful valley on both sides of the river Elbe, which is here spanned by three stone

Age 2 Mother Carrying Letters
Age 3 years 11 months Rhinoceros Stepping out of Water
Age 4 years 1 month Tiger
Age 5 years
Age 7 years
Age 4½ years A Boy
Age 8 The Artist Herself
Age 13 years You Thief!
Age 9½ years From Life
Age 10 years From Life
Age 14 years My Pony

ENCOURAGING YOUNG CHILDREN TO DRAW. SKETCHES SHOWN AT A RECENT EXHIBITION

Young people are now encouraged to draw from almost babyhood to the age of nineteen, whereas in former years a child's scrawls were simply laughed at. These pictures form an interesting series and show the development in drawing from year to year. The three pictures at the bottom of the page are called "snapshot drawings," representing the exercise of the memory and imagination (separately or together) in connection with definite, original, pictorial impressions, obtained under prescribed conditions



STEAM SHOVEL

This wonderful machine has revolutionized the work of excavating and is employed in all large undertakings, 300 shovels being equivalent to the work of an army of half a million men. It is this marvelous machine that has made the digging of the Panama Canal a practical undertaking, and its completion an assured fact.

bridges. It is first mentioned in history in 1206, and has been the residence of the sovereigns since 1485; was greatly extended and embellished by Augustus the Strong (1694–1736), and rapidly increased duing the 19th century. Among the chief edifices besides several of the churches arc the Museum (joined on to an older range of buildings called the Zwinger), a beautiful building containing a famous picture-gallery and other treasures; the Japanese Palace (Augusteum), containing the royal library of from 300,000 to 400,000 volumes, beside a rich collection of manuscripts; the Johanneum, containing the collection of porcelain and the historical museum, a valuable collection of arms, armor, domestic utensils, etc., belonging to the middle ages. The city is distinguished for its excellent educational, literary, and artistic institutions, among which are the Polytechnic School, much on the plan and scale of a university; the Conservatory and School of Music; the Academy of Fine Arts, etc. The chief glory of Dresden is the gallery of pictures, one of the finest in the world, which first became of importance under Augustus II., king of Poland and elector of Saxony, but owes its most valuable treasures to Augustus III., who purchased the greater portion of the gallery of the Duke of Modena. The pictures number about 25,000, and in particular comprise many fine specimens of the Italian, Dutch, and Flemish schools. Besides this fine collection the museum contains also engravings and drawings amounting to upward of 350,000. There is here also a rich collection of casts exemplifying the progress of sculpture from the earliest times, and including copies of all the most important antiques . Pop. (1900), 395,349.

DRESDEN CHINA, a delicate, semi-transparent, highly-finished china made at Meissen, near Dresden. The manufacture resulted from an accidental discovery made by Böttger, a young chemist, in 1710, and the vases, statuettes, groups of figures, candelabra, clocks, etc., manufactured during the 18th century are highly prized. They are more remarkable for excellence of execution than for purity of design.

DREW, Daniel, an American capitalist, born in New York in 1788, died in 1879. He was one of the most important of the earlier railroad builders and developers and was at one time associated with Cornelius Vanderbilt.

DREW, John, an American actor, born in Dublin, Ireland, in 1825, died in 1862. He was well known in his day as a clever comedian.

DREW, John, an American actor, son of John Drew, born in 1853. About 1879 he became the leading man with Daly's company, and in 1892 he appeared as a star. Drew has a wide range of comedy power from Petruchio, in the Taming of the Shrew, to Richard Carvel. He is one of the most popular of American actors.

DREW THEOLOGICAL SEMINARY, a Methodist Episcopal theological school founded in 1866 at Madison, N. J., by donations from Daniel Drew. The property of the seminary amounts to $1,170,000, and the library contains 73,000 volumes. No tuition fees are charged.

DREXEL INSTITUTE of Art, Science, and Industry, an institution founded by Anthony Drexel at Philadelphia in 1891. The buildings and endowments aggregate $6,000,000, technical courses are given, and there is a registration of perhaps 5,000 students. The library contains 30,000 volumes, and the institute conducts extension lectures and courses of great utility.

DREYFUS, Alfred, a French officer of artillery, who was convicted of treason in 1894, stripped of his uniform and banished to the Ile du Diable off the coast of Guiana. During his imprisonment his friends unearthed the conspiracy which caused his conviction, and Dreyfus was recalled, re-tried and fully acquitted. His rank and uniform were returned to him; he was made an officer of the Legion of Honor and other honors were done him, one especially being worthy of mention, that of placing the body of Emile Zola in the Pantheon because he had defended the honor of Dreyfus. Although the case made a great stir its chief interest (aside from the sufferings of the victim) hinges on the stupidity of the French courts and the hatred of the French for Jews.

DRIFT, in geology, a term applied to earth and rocks which have been conveyed by icebergs or glaciers and deposited over the surface of a country; variously called Diluvium, Diluvial, Glacial, or Northern Drift, Boulder Formation, etc. Geologists now often use instead of Drift the terms stratified or unstratified Boulder Clay, which were not formerly recognized as distinct formations.

DRIFT, in mining, the course or direction of a tunnel or gallery; or a passage between two mine shafts.

DRIFT SAND, sand thrown up by the waves of the sea, and blown when dry some distance inland until arrested by large stones, tree roots, or other obstacles, round which it gradually accumulates until the heaps attain considerable dimensions, often forming dunes or sand-hills.

DRILL, a tool used for boring holes in wood, metal, stone, ivory, etc. It consists of a sharp chisel to which a circular motion is communicated by various contrivances. For drilling iron, steel, etc., a lathe driven by steam is generally used, the drill being fixed into a chuck and the work pressed against it as it revolves. For rock-boring the diamond rock-drill, an instrument with cutting edges made of boart or black diamond, is now generally adopted. See Boring.

DRILL, a fine linen texture of a satiny finish, used for gentlemen's summer dresses. Plain drills are worked with five shafts, fancy patterns with eight.

DRILL, the course of instruction in which a soldier or sailor is taught the use of arms and the practice of military and naval evolutions.

DRILL, a species of baboon, of a smaller size and less fierce disposition than the mandrill, and like it a native of the coast of Guinea. The face and ears are bare and of a glossy black color, the palms of the hands and soles of the feet are also naked and of a deep copper color.

DRILLING, the plan of sowing in parallel rows as distinguished from sowing broadcast. The crops which are now generally drilled are turnips, potatoes, beans, pease, carrots, clover, cereals, flax, etc. The first form of drill was of very simple construction, and was only adapted for sowing one row at a time, but now a great variety of improved implements are in use.

DRINK. See Dietetics.

DRINKING FOUNTAIN, an erection, often ornate and artistic, on or near a public thoroughfare or place of resort, for supplying people, and sometimes also horses, dogs, etc., with water to quench their thirst,

DRIPSTONE, a projecting tablet or molding over the head of a doorway, window, archway, or niche to throw off the rain. It is also called a weather

Dripstone, Westminster Abbey.

molding, and label when it is turned square. It is of various forms; sometimes a head is used as a termination or support, at others an ornament or simple molding is adopted.

DRIVING-WHEEL, in machinery, a wheel that communicates motion to another or others; in railway locomotives the large wheel which is fixed upon the crank-axle or main shaft.

DROME, a southeast department of France, covered almost throughout by ramifications of the Alps, the average height of which, however, does not exceed 4000 feet; area, 2508 sq. miles. Valence is the capital. Pop. 314,615

DROMEDARY, the Arabian and African camel, difierent from the Bactrian camel in having only one hump on the back. It has also more slenderness and symmetry of form. Its usnal pace is a

Dromedary, or Arabian camel.

trot, which it often maintains for many hours together at the rate of 9 miles an hour. The dromedary surpasses other camels in speed, and can travel several several days without drink. It is extensively used as a beast of burden in Africa and Arabia.

DROPSY, a disease which consists in the collection of serous or watery fluid in the cellular tissue, or in different cavities of the body. It receives different appellations according to the particular situation of the fluid. When it is diffused through the cellular tissue, either generally or partially, it is called anasarca; when it is deposited in the cavity of the cranium it is called hydrocephalus; when in the chest, hydrothorax, or hydrops pectoris; when in the abdomen, ascites; in the uterus, hydrometra; within the scrotum, hydrocele; and within the ovary, ovarian dropsy. Obstructive organic disease of the heart and degenerative diseases of the kidneys are the most common causes of general dropsy. The treatment often includes removal of the fluid from the cavities containing it by tapping or puncturing; otherwise drugs which stimulate excretion by the skin, bowels, and kidneys are employed, but all remedies frequently prove ineffectual.

DROSKY, a kind of light, four-whecled carriage used by the Russians. It is not covered, and in the middle there rises a sort of bench placed lengthwise on which the passengers ride as on a saddle; but the name is now applied to various kinds of vehicles, as to the common cabs plying in the streets of German cities, etc.

DROWNING means death by the air being prevented entering the lungs owing to the mouth and nostrils being immersed in a liquid, the liquid being commonly water. Death may, therefore, occur by drowning in a small quantity of water. Thus a child may fall head downwards into a tub and be drowned, though the tub is not half full of water, sufficient to cover the mouth and nostrils being all that is necessary and a man overcome by a fit or by drunkenness may fall on a road with his head in a ditch or pool of water, and thus meet death. Death is thus due to suffocation, to the stoppage of breathing and to the entrance of water into the lungs. When death has been caused by drowning, the skin presents the appearance called goose-skin (cutis anserina), the face and surface of the body generally are usually pale, a frothy liquid is found in the lungs and air-passages, and about the lips and nostrils; water may be found in the stomach and clenched fingers, holding substances grasped at, may serve to show that a struggle had taken place in the water and that the body was alive at the time of immersion. Complete insensibility arises, it is probable, in from one to two minutes after submersion, recovery, however, being still possible, and death occurs in from two to five minutes. So long as the heart continues to beat, recovery is possible; after it has ceased it is impossible. Newly born children and young puppies stand submersion longer than the fully grown.

Remedies: Pull the body up on to dry ground. Send immediately for medical assistance, warm blankets, dry clothing, brandy and hot water, if any one is at hand to send. No delay must be permitted, however, in treating the person, so that if only one person is on the spot, he must begin to treat the person instantly, without seeking assistance. Remove all clothing from the neck and chest. Fold the article of dress removed so as to make a firm pillow, which is to be placed under the shoulders, so that the upper part of the body is slightly raised and the head slightly thrown back. Cleanse the mouth and nostrils, open the mouth and pull forward the tongue. If natural efforts to breathe are made, try to stimulate them by brisk rubbing of the sides of the chest and of the face. If no effort to breathe is made, proceed to produce the entrance and outflow of air from the lungs by Sylvester's or Howard's method.

Sylvester's method: Stand or kneel behind the person's head, grasp each arm at the elbow, draw both arms simultaneously upward till they are extended in line with the body, as a man places them when he stretches himself. Let this movement occupy about 2 seconds. This enlarges the chest and causes the entrance of air to the lungs. Without a pause carry the arms down to the sides, making them overlap the chest a little, and firmly press them on the chest. This movement should occupy another 2 seconds. It expels air from the lungs. Repeat the movements, and maintain them steadily and patiently at the rate of 15 times a minute, until breathing has been fully restored, or until medical aid arives, or until death is certain. An hour is not too long a time to persist, and so long as there seems at least effort to breathe the efforts must be persevered in.

Howard's method: Place the body on its face, with the roll of clothing under the stomach; the head being supported on the hand as shown in Figure 1. Pull the body over the roll of clothing to expel water from the chest. Then turn the body on the back, the shoulders being supported as shown in Fig. 2. Kneel over the body. Place both hands on the lower part of the chest, so that the thumbs hook in under the lowest ribs and the fingers are spread out on the chest. Steadily press forward, raising the ribs, your own body being thus thrown leaning forward. This enlarges the cavity of the chest and causes air to enter. When the ribs have been raised to the utmost extent, with a slight effort push yourself back to the more erect position, allowing the ribs to recoil to their former position. This expels the air. Repeat the process 15 times a minute. One person will find it more easy to maintain this method for a prolonged period than Sylvester's, especially if the patient be big and heavy.

Howard's method for restoring the apparently drowned.

Meanwhile, if other persons are present they should be occupied rubbing the body and limbs (always upward) with hands or warm flannel, applying hot flannels, bottles, etc., to the limbs, feet, arm-pits, etc. As soon as the person is sufficiently restored to be able to swallow, give small quantities of hot brandy and water, hot wine and water, hot coffee, etc., and use every effort to restore and maintain warmth.

Drowning was formerly a mode of capital punishment in Europe. The last person executed by drowning in Scotland suffered death in 1611. In Ireland there was an execution by drowning as late as 1777.

DRUGGET, a coarse kind of woolen felt or cloth, formerly used by the lower classes for purposes of clothing, but now chiefly used as a covering for carpets.

DRUGS, a general name for any substances, vegetable, animal or mineral, used in the composition or preparation of medicines; also applied to ingredients used in chemical preparations employed in the arts.

DRUIDS, the priests of the Celts of Gaul and Britain. According to Julius Cæsar they possessed the greatest authority among the Celtic nations. They had some knowledge of geometry, natural philosophy, etc., superintended the affairs of religion and morality, and performed the office of judges.

DRUM, a musical instrument of percussion, of Eastern origin, either cylin-

drical or hemispherical in shape, with the end or ends covered with tightened parchment, which is stretched or slackened at pleasure by means of cords with sliding knots or screws. Drums are of three kinds: (1) the long or bass drum played with stuffed-nob drum-sticks, and used only in large orchestras or military bands; (2) the side-drum, having two heads, the upper one only being played upon by two sticks of wood; (3) the kettle-drum, a hemisphere of brass or copper, the end of which is covered with parchment, always used in pairs, one drum being tuned to the key-note, and the other to the fifth of the key, the compass of the two together being an octave.

DRUM-FISH, and other species of the same genus, fishes found on the Atlantic coasts of N. America, and so named from the deep drumming sound they make. They often weigh about 20 lbs.

DRUM-MAJOR, or **SERGEANT-DRUMMER,** a non-commissioned officer whose duty it is to teach and direct the drummers. He marches at the head of the band carrying the regimental baton.

DRUMMOND, Prof. Henry, was born at Stirling in 1851, and educated at the universities of Edinburgh and Tübingen. He died in 1897. He traveled much, and wrote a popular book on Tropical Africa (1888). His most remarkable work is Natural Law in the Spiritual World (1883), which has passed through many editions and been translated into various languages. He is author also of Travel Sketches in Our New Protectorate; The Greatest Thing in the World; The Ascent of Man (1894), etc.

DRUMMOND, Thomas, the inventor of the lime-ball light known by his name, was born in Edinburgh in October, 1797, and died at Dublin, April 15, 1840. He invented a heliostat, and first used the light which bears his name about 1825 during the survey of Ireland. He subsequently entered political life, and became in 1835 under-secretary for Ireland, a country which he practically ruled with the utmost success for five years.

DRUMMOND LIGHT, a very intense light produced by turning two streams of gas, one of oxygen and the other of hydrogen, in a state of ignition upon a ball of lime. This light was proposed by Capt. Drummond to be employed in light-houses. See Lime-light.

DRUNKENNESS, the state of being drunk or overpowered by alcoholic liquor, or the habit of indulging in intoxication. A similar condition may be produced by numerous agents, but the term is always applied to the act or habit of drinking alcoholics to excess. Drunkenness is no excuse for any crime, but it renders a contract invalid if either of the parties was in a state of complete drunkenness when the contract was signed.

DRUSUS, the name of several distinguished Romans, among whom were:—Marcus Livius, orator and politician; became tribune of the people in 122 B.C. He opposed the policy of Caius Gracchus, and became popular by planting colonies.—Marcus Livius, son of the above, was early a strong champion of the senate or aristocratic party, but showed great skill in manipulating the mob. He rose to be tribune of the people, and was assassinated B.C. 91.—Nero Claudius, brother of the Emperor Tiberius, born B.C. 38. By a series of brilliant campaigns he extended the Roman empire to the German Ocean and the river Elbe, and was hence called Germanicus. By his wife Antonia, daughter of Mark Antony, he had a daughter, Livia, and two sons, Germanicus and Claudius, the latter of whom afterward became emperor. He died in B.C. 9.

DRY'ADS, wood nymphs, in the Greek mythology; supposed to be the tutelar deities of trees. Each particular tree or wood was the habitation of its own special dryad.

DRY'DEN, John, English poet, was born near Aldwinkle, Northamptonshire, in 1631, and went to Trinity College, Cambridge, being here elected to a scholarship. After leaving the university he went to London, and on the death of

John Dryden.

the Protector he wrote his Heroic Stanzas on that event. In 1661 he produced his first play, The Duke of Guise. This was followed by The Indian Queen, a tragedy, and The Indian Emperor, which at once raised Dryden to the highest pitch of public estimation, an elevation which he retained till his death. He published a translation of Juvenal, and one of Persius. About a third part of Juvenal was translated by Dryden, who wrote an essay on satire which was prefixed to the whole. His poetic translation of Virgil appeared in 1697, and, soon after, that masterpiece of lyric poetry, Alexander's Feast, his Fables, etc. He died May 1st, 1700, in the sixty-ninth year of his age, and was buried in Westminster Abbey. Dryden is unequalled as a satirist among English poets, and the best of his tragedies are unsurpassed by any since written. His poetry as a whole is more remarkable for vigor and energy than beauty, but he did much to improve English verse. He was also an admirable prose writer. Personally he was modest and kindly.

DRYING-MACHINE, a machine used in bleaching, dyeing, and laundry establishments, consisting of two concentric drums or cylinders, one within the other, open at the top, and having the inner cylinder perforated at its side with numerous small holes. The goods to be dried are placed within the inner cylinder, and the machine is then made to rotate with great velocity, when, by the action of centrifugal force, the water escapes through the holes in the side. The action of the drying-machine is the same in principle as that witnessed when a person trundles a mop to dry it.

DRYING-OIL, the name given to linseed and other oils which have been heated with oxide of lead; they are the bases of many paints and varnishes. When exposed to the air they absorb oxygen, and are converted into a transparent, tough, dry mass or varnish.

DRY-POINT, a sharp-pointed instrument used by engravers to incise fine lines in copper without the plate being covered with etching-ground or the lines bit in by acid. This tool is much employed in working the more delicate portions of plates produced as etchings.

DRY-ROT, a well-known disease affecting timber, occasioned by various species of fungi, the mycelium of which penetrates the timber, destroying it.

DUAL, in grammar, that number which is used, in some languages, to designate two things, whilst another number (the plural) exists to express many. The Greek, Sanskrit, and Gothic of ancient languages, and the Lithuanian and Arabic of modern, possess forms of the verb and noun in which two persons or things are denoted, called the dual numbers.

DUBAR'RY, Marie Jeanne, Comtesse, mistress of Louis XV., was born at Vaucouleurs 1746. She came young to Paris, entered on an immoral course, and was presented to the king in 1769, who had her married for form's sake to the Count du Barry. She exercised a powerful influence at court, and with some of her confidants completely ruled the king. Important offices and privileges were in her gift, and the courtiers abased themselves before her. After the death of Louis she was dismissed from court and sent to live in a convent near Meaux. She received a pension from Louis XVI. During the reign of terror she was arrested as a royalist and executed, Nov. 1793.

DUB'LIN, the metropolis of Ireland, is situated in co. Dublin, on the east coast of the island, at the mouth of the Liffey, the banks of which for more than two miles from the sea are lined with quays. The river, which divides the city into two unequal parts, is crossed by numerous bridges. The principal public secular buildings are the Castle, the official residence of the viceroy; the Bank of Ireland, formerly the Irish parliament house; Trinity College; the courts of justice; the custom-house; the King's Inns; the post-office; rotunda; corn exchange; commercial buildings; the mansion house; city hall or corporation buildings; etc. The most important literary and scientific institutions are Trinity College (Dublin University); the Royal University; the Royal College of Science; the Roman Catholic University; the College of Surgeons; the Royal Dublin Society; the Royal Hibernian Academy of Painting, Sculpture and Architecture; the Royal Irish Academy for Promoting the Study of Science, Literature, and Antiquities; the Archæological Society; the Royal Zoological Society; etc. Dublin contains two Protestant Episcopal cathe-

drals—St. Patrick's Cathedral, erected in 1190, and thoroughly restored between 1860 and 1865; and Christ's Church, built in 1038 and also recently restored, both restorations being carried on by private munificence. The Roman Catholic Cathedral is a very large edifice. A little northwest of the city, up the Liffey, is the Phœnix Park, with an area of 1759 acres. In it are the Viceregal Lodge, the residence of the Lord Lieu-

Sackville street, Dublin, showing the O'Connell monument, the post office, and the Nelson monument.

tenant; the chief secretary's and under secretary's official residences; the Royal Hibernian Military School, and the depot of the Royal Irish Constabulary; as also the gardens of the Royal Zoological Society. The manufactures carried on are of little note: poplins, for which Dublin has been long celebrated, are still in some request, and brewing and distilling are largely carried on. Pop. 289,108.—The county, which is in the province of Leinster, on the east coast of the island, has an area of 226,-895 acres, or 354 square miles, about a third of it under crops of various kinds, chiefly grass and clover. Pop. 447,266.

DUBLIN, University of, an institution founded in 1591, when a charter, or letters-patent, was grantd by Queen Elizabeth for the incorporation of the "College of the Holy and Undivided Trinity," the University and Trinity College being practically the same. The corporation now consists of a provost, seven senior fellows, twenty-six junior fellows, and seventy foundation scholars. The senate of the university consists of "the chancellor of the university, or, in his absence, of the vice-chancellor, and such doctors or masters of the university as shall have and keep their names on the books of Trinity College." The senate possesses the right of electing the chancellor of the university; it is also the body which grants degrees. The fellows are appointed for life, after an examination. The scholars are chosen from among the under-graduates, after an examination in mathematics and logic, or in Greek, Latin, and logic. The scholarships are tenable for five years, or till the degree of M.A. is attained. The course of general instruction extends over four years. The college possesses a library of about 200,000 printed volumes and 1700 manuscripts. It has also a botanic garden and museum.

DUBUQUE (du-buk'), a city in Iowa, on the right bank of the Mississippi. It occupies an important commerical position as a railway center and entrepôt for the agricultural and mineral products of the northern half of Iowa, and the timber of Wisconsin, and also from the valuable lead-mines in its vicinity. Pop. 1909, 50,000.

DU CHAILLU (du-shā-yü), Paul Belloni, traveler, born in Paris, 1835. He spent his youth in the French settlement at the Gaboon, on the west coast of Africa, where his father was a merchant. In 1852 he came to the U. States, of which he afterward became a naturalized citizen. In 1855 he began his first journey through western Africa, and spent till 1859 alone among the different tribes, traveling on foot upward of 8000 miles. He collected several gorillas never before hunted, and rarely, if ever, before seen by any European. The result of this journey was published in 1861. A second expedition was made in 1863, an account of which, under the title A Journey to Ashango Land, appeared in 1867. The Land of the Midnight Sun, an account of a tour in northern Europe (1881), had a considerable success. He died in 1903.

DUCK, the name common to all the web-footed birds constituting the land-ducks and sea-ducks. The ducks are very numerous as species, and are met with all over the world. They are often migratory, going northward in summer to their breeding-places. Their food is partly vegetable, partly animal. The common mallard or wild-duck is the original of the domestic duck. In its wild state the male is characterized by the deep green of the plumage of the head and neck, by a white collar separating the green from the dark chestnut of the lower part of the neck, and by having the four middle feathers of the tail recurved. The wild-duck is taken in large quantities by decoys and other means. Some tame ducks have nearly the same plumage as the wild ones; others vary greatly, being generally duller or pure white, but all the males have the four recurved tail-feathers. There are several favorite varieties of the domestic duck, those of Normandy and Picardy in France, and the Aylesbury ducks in England, being remarkable for their great size and delicacy of flesh. The musk-duck, erroneously called Muscovy duck, a native of south America, is the largest of the duck kind, and approaches nearly to the size of a goose. The canvas-back duck is peculiar to America, and is celebrated for the excellence of its flesh. Other species of ducks are the shoveler, remarkable for the strange form of its bill; the gadwall, which is more rare in America than in Europe; the pintail or sprigtail, remarkable for the form of its tail, abundant in both hemispheres; the black or dusky duck, peculiar to America, and very abundant; the summer or wood duck, remarkable for its great beauty, and for its migrations being directly opposed to those of the other species; the teal; the eider-duck, so well known for its valuable down; the scoter; the pochard or red-head; the scaup-duck or blue-bill; the long-tailed duck; the harlequin-duck all found on both continents.

DUCK, a species of coarse cloth made of flax, lighter and finer than canvas.

DUCKING-STOOL, a stool or chair in which common scolds were formerly tied and plunged into water. They were of different forms, but that most commonly in use consisted of an upright post and a transverse movable beam on which the seat was fitted or from which it was suspended by a chain. The ducking-stool is mentioned in the Doomsday survey: it was extensively in use throughout the country from the 15th till the beginning of the 18th century, and in one rare case at least—at Leominster—was used as recently as 1809.

DUCKWEED, the popular name of several species of plants growing in ditches and shallow water, floating on the surface, and serving for food for ducks and geese. Five species are known in Britain, and others are common in America. They consist of small fronds bearing naked unisexual flowers.

DUCTIL'ITY, the property of solid bodies, particularly metals, which renders them capable of being extended by drawing, while their thickness or diameter is diminished, without any actual fraction or separation of their parts. On this property the wire-drawing of metals depends. The following is nearly the order of ductility of the metals which possess the property in the highest degree, that of the first mentioned being the greatest: gold, silver, platinum, iron, copper, zinc, tin, lead, nickel, palladium, cadmium. Dr. Wallaston succeeded in obtaining a wire of platinum only $\frac{1}{30000}$th of an inch in diameter. The ductility of glass at high temperatures seems to be unlimited, while its flexibility increases

in proportion to the fineness to which its threads are drawn.

DUDEVANT (düd-vän), Armantine-Lucile-Aurore Dupin, Madame, better known by the non de plume of George Sand, one of the greatest of French novelists, born 1804, died 1876. In 1822 she married Baron Dudevant, to whom she bore a son and a daughter; but in 1831 separated from him, and took up her residence in Paris. In conjunction with Jules Sandeau, a young lawyer, she wrote Rose et Blanche, which was published in 1831, with the pseudonym Jules Sand. The reception it met with afforded her an opportunity of publishing a novel solely by herself—Indiana, under the name of George Sand, which she ever after retained. Indiana had a brilliant success, but excited much criticism by its extreme views on social questions. This was also the case with many others of her works. She visited Italy with Alfred de Musset; and lived eight years with Frédéric-François Chopin, the composer. These relations also influenced or occasioned some of her works (as Elle et Lui, 1858). In 1836 she obtained a judicial separation from her husband, with the care of her children. She took an active interest in the revolution of 1848, and contributed considerably to newspaper and other political literature. In 1854 she published Histoire de Ma Vie, a psychological autobiography. Her published works consist of upward of sixty separate novels, a large number of plays, and numerous articles in literary journals.

DUE BILL, a brief acknowledgment of indebtedness, generally taking the form of the familiar "I. O. U" (I owe you). It is not a negotiable instrument, it does not promise to pay, but it is legally assignable by the payee.

DUEL, a premeditated and prearranged combat between two persons with deadly weapons, for the purpose of deciding some private difference or quarrel. The combat generally takes place in the presence of witnesses called seconds, who make arrangements as to the mode of fighting, place the weapons in the hands of the combatants, and see that the laws they have laid down are carried out. Upon every insult or injury which seemed to touch his honor, a gentleman thought himself entitled to draw his sword, and to call on his adversary to give him satisfaction, and it is calculated that 6000 persons fell in duels during ten years of the reign of Henry IV. His minister, Sully, remonstrated against the practice; but the king connived at it, supposing that it tended to maintain a military spirit among his people. In 1602, however, he issued a decree against it, and declared it to be punishable with death. Many subsequent prohibitions were issued, but they were all powerless to stop the practice. During the minority of Louis XIV. more than 4000 nobles are said to have lost their lives in duels. The practice of duelling was introduced into England from France in the reign of James I.; but it was never so common as in the latter country. Cromwell was an enemy of the duel, and during the protectorate there was a cessation of the practice. It came again into vogue, however, after the restoration, thanks chiefly to the French ideas that then inundated the court. As society became more polished duels became more frequent, and they were never more numerous than in the reign of George III. In France duelling still prevails to a certain extent; but the combats are usually very bloodless and ridiculous affairs. In the German army it is common, and is recognized by law. The duels of German students, so often spoken of, seldom cause serious bloodshed. In the United States duels are now uncommon. In some of the states the killing of a man in a duel is punishable by death or by forfeiture of political rights, and in a large number the sending of a challenge is a felony. In the army and navy it is forbidden. Among the celebrated duels fought in the U. States were those between Charles Lee and John Laurens, McIntosh and Gwinnett, Cadwallader and Conway, Hamilton and Burr, Dickinson and Jackson, Benton and Lucas, Clinton and Swartout, Randolph and Clay, and Graves and Cilley.

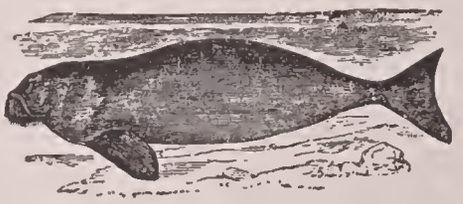
DUEN'NA, the chief lady-in-waiting on the Queen of Spain. In a more general sense, an elderly female holding a middle station between a governess and companion, appointed to take charge of the younger female members of Spanish and Portuguese families.

DUE PROCESS OF LAW, a term used to designate the regular procedure in litigation, prosecution, etc. It is very ancient, having been used in magna charta and also in the constitution of the U. States.

DUET, a musical composition for two voices or instruments.

DUFF'ERIN, Frederick Temple Hamilton-Blackwood, Marquis of, British statesman, born at Florence 1826. He began his public services in 1855, when he was attached to Earl Russell's mission to Vienna. Subsequently he was governor general of Canada and viceroy of India. He died in 1902. Beside being a noted diplomatist he was also a popular author. In 1847 he published Narrative of a Journey from Oxford to Skibbereen during the year of the Irish Famine; in 1860, Letters from High Latitudes; also various pamphlets on Irish qnestions. In 1888 he was made Marquis of Dufferin and Ava.

DU'GONG, a herbivorous mammal, belonging to the order Sirenia, which includes the manatees. It is a native of the Indian seas; possesses a tapering



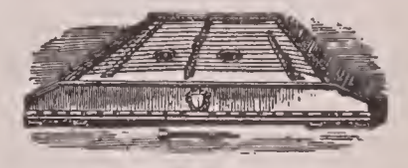
Dugong.

body ending in a crescent-shaped fin, and is said sometimes to attain a length of 20 feet, though generally it is about 7 or 8 feet in length. The skin is thick and smooth, with a few scattered bristles; the color bluish above and white beneath. In its osteology it exhibits some points of correspondence with the Pachydermata. Its food consists of marine plants; it yields little or no oil, but is hunted by the Malays for its flesh, which resembles young beef, and is tender and palatable.

DU GUECSLIN (dü-gā-klāṇ), Bertrand, Constable of France, born about 1314, died 1380. Mainly to him must be attributed the expulsion of the English from Normandy, Guienne, and Poitou. He was captured by Chandos at the battle of Auray in 1364, and ransomed for 100,000 francs. While serving in Spain against Peter the Cruel he was made prisoner by the English Black Prince, but was soon liberated. For his services in Spain he was made Constable of Castile, Count of Trastamare, and Duke of Molinas; and in 1370 he was made constable of France.

DUKE, a title belonging originally to a military leader. In Britain it is the highest rank in the peerage, the corresponding female title being duchess. Royal Dukes have a special status and precedence. The first hereditary duke in England was the Black Prince, created by his father, Edward III., in 1336. The duchy of Cornwall was bestowed upon him, and was henceforward attached to the eldest son of the king, who is considered a duke by birth. The duchy of Lancaster was soon after conferred on Edward's third son, John of Gaunt, and hence arose the special privileges which these two duchies still in part retain. A duke in the British peerage, not of royal rank, is styled "your grace," and is "most noble;" his wife is a duchess. The coronet consists of a richly-chased gold circle, having on its upper edge eight golden leaves of a conventional type called strawberry leaves; the cap of crimson velvet is closed at the top with a gold tassel, lined with sarcenet, and turned up with ermine. (See Coronet.) At various periods and in different continental countries the title duke (Herzog in Germany) has been given to the actual sovereigns of small states. The titles "grand-duke" and "grand-duchess," "archduke" and "archduchess," are in use also on the European continent, the latter to distinguish the princes and princesses of the Austrian imperial family. In the Bible the word dukes is used, Gen. xxxvi., for the duces of the vulgate

DUL'CIMER, one of the most ancient musical instruments, used in almost all parts of the world. The modern instrument consists of a shallow trapezium-shaped box without a top, across which



Italian dulcimer.

runs a series of wires, tuned by pegs at the sides, and played on by being struck by two cork-headed hammers. It is in much less common use in Europe now than it was a century or two ago, and is interesting chiefly as being the prototype of the piano. It is still, however, occasionally to be met with on the Con-

tinent at rustic rejoicings, and in England in the hands of street musicians. The Hebrew psaltery is supposed to have been a variety of the dulcimer.

DULUTH (du-lüth'), capital of St. Louis co., Minnesota, at the s.w. extremity of Lake Superior. The Northern Pacific and Lake Superior. and Mississippi railways terminate here; and extensive docks and other works have been constructed affording a convenient outlet for the surrounding wheat region. 1909, 88,000.

DUMA, name of the Russian consultative national assembly granted to Russia by Czar Nicholas II. Aug. 19, 1905. The first and second duma were dismissed for advocating policies opposed by the government, and in 1908 a third was assembled that was subservient to the bureaucracy.

DUMAS (dü-mä), Alexander, French novelist and dramatist, born at Villers-Cotterets 1803. In 1823 he went to Paris, and obtained an assistant-secretaryship from the Duke of Orleans, afterward Louis Philippe. He soon began to write for the stage, and in 1829 scored his first success with his drama Henry III. It was produced when the battle between the Romanticists and the Classicists was at its height, and hailed as a triumph by the former school The same year appeared his Christine, and in quick succession Antony, Richard d'Arlington, Térésa, Le Tour de Nesle, Catharine Howard, Mlle. de Belle-Isle, etc. Dumas had now become a noted Parisian character. The critics fought over the merits of his pieces, and the scandal-mongers over his prodigality and galanteries. Turning his attention to romance, he produced a series of historical romances, among which may be mentioned, Les Deux Dianes; La Reine Margot; Les Trois Mousquetaires, with its continuations Vingt Ans Après, and Vicomte de Bragelonne. His Monte Cristo and several others are also well known to English readers through translations. Several historical works were also written by him. The works which bear his name amount to some 1200 volumes, including about 60 dramas; but the only claim he could lay to a great number of the productions issued under his name, was that he either sketched the plot or revised them before going to press. He earned vast sums of money, but his recklessness and extravagance latterly reduced him to the adoption of a shifty, scheming mode of living. In 1860 he accompanied Garibaldi in the expedition which freed Naples from the Bourbons. He died at the residence of his son, at Puys, near Dieppe, in 1870.

Alexander Dumas.

DUMAS, Alexander, son of the above, born 1824; novelist and dramatist. His works treat mostly of the relations between vice and morals. His first novels, La Dame aux Camélias and Diane de Lys, were very successful, as were also the plays which were founded on them. His dramas, which are much superior to his novels, deal satirically with the characters, follies, and manners of French society. He died in 1895.

DU MAURIER (dü-mō'ri-ā), George Louis Palmella Busson, artist and writer, was born in Paris 1834. After studying in Belgium and France he returned to London, and soon began to contribute drawings to Punch, Once a Week, Cornhill Magazine, etc. He succeeded Leech on Punch, and became famous chiefly through his drawings for that publication. He also illustrated various books, and wrote Trilby and two other tales. He died in 1896

DUMB. See Deaf and Dumb.

DUMBAR'TON, a royal and parliamentary burgh and seaport, Scotland, chief town of Dumbarton co., stands on the Leven near its junction with the Clyde, 16 miles w.n.w. Glasgow. Shipbuilding is carried on to a great extent, etc. Pop. 113,870.

DUMB-BELLS, weights usually in the form of two iron balls connected by a straight piece for holding, used in gymnastic exercises for strengthening the muscles of the arms and chest.

DUMBNESS. See Deaf and Dumb,

DUMFRIES (dum-frēs'), a river port, railway center, and parliamentary burgh, Scotland, capital of the county of same name, and the chief place in the south of Scotland. There are iron-foundries, hosiery and tweed factories, tanneries, coach-building works, etc. Dumfries is a place of great antiquity. The church of the Minorites which once stood here was the scene of the murder of the Red Comyn by Bruce in 1306. Burns spent his closing years here, and the street in which he lived now bears his name. His remains rest under a handsome mausoleum, and a statue of him was erected in 1882. Pop. 20,240.—The county abuts on the Solway Firth, having on its borders the counties of Lanark, Peebles, Selkirk, Roxburgh, Ayr, and Kirkcudbright; area, about 1100 sq. miles or 702,946 acres, of which about a third are under cultivation. The minerals most abundant are coal, lead, iron, antimony, and gypsum. Coal and lead are worked to a small extent. Limestone and freestone abound in various parts. Its principal towns are Dumfries, Annan, Sanquhar, Lockerbie, Moffat, and Lochmaben. Pop. 72,569.

DUMOURIEZ (dü-mō-ri-ā), Charles François Duperrier, a French general of great military talent, was born at Cambrai in 1739, died near Henley-on-Thames 1823. He served as an officer in the Seven Years' war. In 1778 he was appointed governor of Cherbourg; in 1792 he was minister of foreign affairs. War breaking out between France and Austria he resigned in order to take command of the army; invaded Flanders, and defeated the Austrians at Jemappes and conquered Belgium. Instead of prosecuting the war vigorously he now entered upon measures for the overthrow of the revolutionary government, issued a proclamation, in which he promised the restoration of the constitutional monarchy in the person of the heir to the crown, but was attacked by the Versailles volunteers, and compelled to flee (April 4, 1793). The convention set a price of 300,000 livres upon his head. At first he retired to Brussels, and after various wanderings found a final refuge in England, where he died in 1823.

General Dumouriez.

DUNABURG (dü'na-bürg), or Dvinaburg, a fortified town, Russia, government of Vitebsk, on the right bank of the Düna, or Dvina, 112 miles southeast from Riga. It carries on various industries, a considerable trade, and has three yearly fairs. The official name is Dvinsk. Pop. 72,518.

DUNBAR, Paul Laurence, an American negro poet, born in Ohio in 1872 died 1906. He published several volumes of poetry of considerable merit, among them being Oak and Ivy, Lyrics of Lowly Life, Poems of Cabin and Field, and Lyrics of the Hearth Side, When Melandy Sings, Howdy, Honey, Howdy, etc. Dunbar's verses were commended by William Dean Howells, to whose encouragement the poet owed much of his perseverance.

DUNBAR', William, the most eminent of all the old Scottish poets, was born, probably in East Lothian, about 1460–65. On the marriage of James IV. to Margaret of England Dunbar celebrated the event in a poem of great beauty, entitled, The Thistle and the Rose. He died about 1520.

DUN'CIAD, THE, a celebrated satirical poem by Pope, in which he gibbets his critics and foes. The first three books were published in 1728; the fourth book, or New Dunciad, appeared in 1742, with illustrations by Scriblerus and notes variorum. Cibber was latterly substituted for Theobald as the hero; and among others who figured in the satire were Ambrose Philips, Blackmore, Bentley, Defoe, Dennis, Shadwell, Settle, etc.

DUNDEE', a city, royal and parliamentary burgh, and seaport, Scotland, in the county of Forfar, on the north shore of the Firth of Tay, about 8 miles from the open sea, 37 miles n.n.e. of

Edinburgh. The most conspicuous building is St. Mary's Tower, or the Old Steeple as it is popularly called, 156 feet high, erected in the middle of the 14th century, and to which three modern parochial churches have been built in form of a cathedral, the nave, choir, and transept respectively forming a separate church. Among public buildings are: the town-hall, several public halls, the high school, exchange, infirmary, lunatic asylum, Albert Institute and free library, etc. The chief educational institution is the University College, for males and females, whose first session opened in 1883. The town has long been celebrated for its textile manufactures, particularly those of the coarser descriptions of linen, and it is now the chief seat of the linen trade in Scotland and of the jute trade in Great Britain, there being a great number of mills and factories engaged in the spinning and weaving of flax, jute, and hemp. Ship-building is extensively carried on, and there are large engineering establishments, etc. Population 160,871.

DUNDON'ALD, Thomas Cochrane, Tenth Earl of, British admiral, was born in Lanarkshire 1775, died 1860. In 1800 he was appointed to the Speedy sloop-of-war of fourten guns, and in the course of thirteen months captured over fifty vessels. In 1805, while in command of the Pallas frigate, he took some rich prizes, and for the next four years in the Impérieuse performed remarkable exploits in cutting out vessels, storming batteries, destroying signals, etc. On his return to England he entered parliament, and by his attacks on the abuses of the naval administration made himself obnoxious to the authorities. In 1818 he took service in the Chilian navy, his exploits greatly aiding the national independence of that country, as well as soon after of Brazil. He did much to promote the adoption of steam and the screw propeller in war ships.

DUNEDIN (dun-ē'din), capital of the provincial district of Otago, New Zealand, and the most important commercial town in the colony, stands at the upper extremity of an arm of the sea,

about 9 miles from its port, Port Chalmers, with which it is connected by railway. Though founded in 1848, its more rapid progress dates only from 1861, when extensive gold-fields discovered in Otago attracted a large influx of population. Wood is the staple export. There is a regular line of steamers between this port and Melbourne and communication is frequent with all ports of New Zealand. Population 52,390.

DUNES, low hills of sand accumulated on the sea-coasts of Holland, Britain, Spain, and other countries, in some places encroaching on and covering what once was cultivated land, but in others serving as a natural barrier to protect the country from the destructive encroachments of the sea.

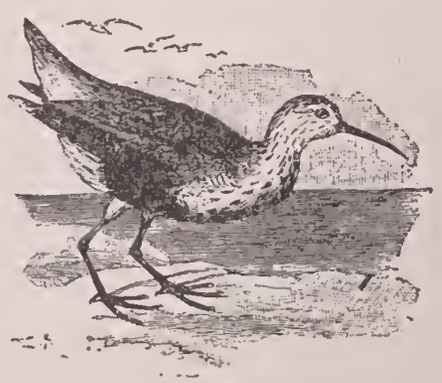
DUNGARPUR (dön-gar-pör'), an Indian native state in Rajputana; area, 1000 sq. miles; pop. 153,381.—Dungarpur is also the name of the chief town and residence of the Maharawal of the state.

DUNG BEETLE, a name applied to a large number of coleopterous insects from their habit of burying their eggs in dung.

DUNKERS, or **TUNKERS,** a religious sect in America, founded by Conrad Peysel, a German, in 1724, and which takes its name from the Ger. tunken, to dip, from their mode of baptizing converts. They reject infant baptism; use great plainness of dress and language; refuse to take oaths or to fight; and anoint the sick with oil in order to their recovery, depending on this unction and prayer, and rejecting the use of medicine. Every brother is allowed to speak in the congregation, and their best speaker is usually set apart as their minister. Called also Dippers, but by themselves Brethren.

DUNKIRK, a city, port of entry, and railway center in Chautauqua co., N. Y.; situated on Lake Erie, 40 miles s.w. of Buffalo. It is the western terminus of the Erie R. R., which connects it with New York city, 459 miles distant, and has a good harbor and an advantageous position for trade. Pop. 13,726.

DUN'LIN, a British bird, a species of sandpiper, occurring in vast flocks along sandy shores. It is about 8 inches in length from the point of the bill to the extremity of the tail, and its plumage



Dipper.

undergoes marked variations in summer and winter, the back passing from black with reddish edges to each feather, to an ashen gray, and the breast from mottled black to pure white. The American red-backed sandpiper is a different variety of dunlin, larger and with a longer or more decurved bill.

DUNLOP', a parish of Ayrshire, Scotland, which has given its name to an esteemed variety of cheese.

DUN'NAGE, faggots, boughs, or loose wood laid in the hold of a ship to raise heavy goods above the bottom to prevent injury from water; also loose articles of lading wedged between parts of the cargo to hold them steady.

DUNNE, Finley Peter, an American humorist, born at Chicago in 1867, and from 1885 to 1891 engaged as reporter, and later as editor and editorial writer for Chicago newspapers. In 1898 he published his first book of humor, "Mr. Dooley in Peace and War." Since that time he has published several other volumes, all devoted to the sayings of "Mr. Dooley," a convenient medium for the propagation of Mr. Dunne's deep and searching satire on human society and its shams. Mr. Dunne is probably the foremost of American humorists.

DUNOIS (du-nwä), Jean, Count of Orleans and of Longueville; a French hero, natural son of Louis, duke of Orleans, born 1402, died 1468. Dunois made the name "Bastard of Orleans" illustrious by his military exploits. He began his career with the defeat of Warwick and Suffolk, whom he pursued to Paris. Being besieged by the English he defended Orleans until relieved by the Maid of Orleans. In 1450 he had completely freed France from the English, and was rewarded by the title of "deliverer of his country," the county of Longueville, and the dignity of high chamberlain of France.

DUNS, John, commonly called Duns Scotus, an eminent scholastic divine, born 1265 or 1275, but whether in England, Scotland, or Ireland is uncertain. In 1304 he went to Paris, and was appointed professor and regent in the theological schools, in which situation he acquired the title of "the subtle doctor." Duns opposed Thomas Aquinas on the subject of grace and free-will; and hence the Scotists are opposed to the Thomists. Duns was the apostle of realism, which was opposed to the systems of nominalism and conceptualism promulgated by the other sections into which the schoolmen were divided. He died, it is said, at Cologne in 1308, leaving behind him numerous works.

DUNWOODY, Henry Harrison Chase, an American meteorologist, born in Ohio in 1842. Educated at West Point, he served for a time in the army, especially with the signal service and organized a large number of the weather stations in the U. States. He has published a number of important papers on meteorological subjects.

DUODECIMAL SYSTEM, in numeration, a system of numbers the scale of which is twelve. Duodecimals is a term applied to an arithmetical method of ascertaining the number of square feet, etc., in a rectangular area or surface whose sides are given in feet, inches and lines.

DUODEC'IMO (often contracted 12mo.) is that form of volume in which each leaf forms a twelfth part of the sheet.

DUODE'NUM, the commencement of the intestinal canal, the first of the smaller intestines, so called because its length is about twelve fingers' breadth (Lat. duodeni, by twelves).

DUQUESNE (dōō-kān′), a town in Allegheny County, Pa., one mile from McKeesport; on the Monongahela River, and on the Pennsylvania railroad. Its steelworks and blast-furnaces are extensive. Pop. 10,416.

DURAN′GO, a town in Mexico, capital of the state of Durango, about 500 miles n. w. Mexico, on an elevation 6845 feet above the sea. It is well built, has a cathedral, a mint, manufactures of cotton and woolen goods, leather, etc. Pop. 20,000.—The state (area, 42,530 sq. miles) is partly mountainous and unproductive, but has valuable gold, silver, and iron mines, and also fertile tracts. Pop. 196,852.

DUR′BAN, the chief port of the colony of Natal, S. Africa, on a landlocked bay (Port Natal). Pop. 57,000.

DURER (dü′rĕr), Albert, German painter, designer, sculptor, and engraver on wood and metal, born at Nürnberg 1471, died there 1528. In 1505 he went to Venice to improve himself in his art.

Albert Dürer.

His abilities excited envy and admiration. He painted the Martyrdom of Bartholomew for St. Mark's church, which painting was purchased by the Emperor Rudolph and removed to Prague. He also traveled to Bologna, to improve his knowledge of perspective. On his return to Nürnberg his fame spread far and wide. Maximilian I. appointed him his court-painter, and Charles V. confirmed him in this office. All the artists and learned men of his time honored and loved him, and for many years he was one of the chief burghers of his native town. Profound application and great facility in the mechanical part of his art were the characteristics of Durer, and enabled him to exert a great influence on German art. He was the first in Germany who taught the rules of perspective, and of the proportions of the human figure. He not only made use of the burin, like his predecessors, but was also among the first to practice etching. He invented the method of printing woodcuts with two colors.

DU′RESS, in law, restraint or compulsion, is of two kinds: duress of imprisonment, which is imprisonment or restraint of personal liberty; and duress by menaces or threats (per minas), when a person is threatened with loss of life, or with some kind of injury. An act done under duress is voidable or excusable.

DURGA (dur′gä), a Hindu divinity, one of the names given to the consort of Siva. She is generally represented with ten arms. In one hand she holds a spear, with which she is piercing Mahisha, the chief of the demons, the killing of whom was her most famous exploit; in another

Durga.

a sword; in a third the hair of the demon chief; and in others, the trident, discus, ax, club, and shield. A great festival in her honor, the Durga puja, is celebrated annually, lasting for ten days.

DURHAM (du′ram), an ancient city and parliamentary borough in England, capital of the county of the same name, on the river Wear, which is crossed here by four bridges, 14 miles s. of Newcastle. The principal public buildings are the ancient castle—now appropriated to the uses of the university—the cathedral, and other churches, the town-hall, county prison, grammar-school, etc. The educational institutions comprise the university, the grammar-school, a training-school for schoolmistresses, and other schools. There are manufactures of carpeting and mustard. The cathedral occupies a height overlooking the Wear. The larger portion of it is Norman in style, with insertions in all the English syles. Three magnificent and elaborately ornamented towers spring up from the body of the building, one from the center 212 feet high, and two together from the west end each 143 feet high; the entire length is 420 feet. It was founded by William de Carilepho, assisted by Malcolm, king of Scotland, in 1093. Pop. 14,641.—Durham University was founded in 1832, opened in 1833, incorporated by royal charter in 1837. It is in some relations connected with the bishopric of Durham, the office of warden being annexed to the deanery of Durham, and a canonry in the cathedral being annexed to each of the professors of divinity and classical literature. There are also professors of mathematics, Hebrew, medicine, etc. There are a college of physical science and a college of medicine at Newcastle-on-Tyne in connection with the university.—The county is on the n.e. coast of England, having on the e. the German Ocean, on the n. Northumberland, from which it is divided by the rivers Tyne and Derwent, Cumberland on the w., and Yorkshire on the s., the river Tees parting the two counties. Its area is 647,592 acres, of which two-thirds are under cultivation. The chief towns besides Durham are Sunderland, Gateshead, S. Shields, Stockton, Darlington, and Hartlepool. Pop. 1,187,324.

DUROC (dü-rok), Michel Gérard Christophe, Duke of Friuli, a distinguished general under Bonaparte, was born at Pont-à-Mousson in 1772; killed, 1813, at the battle of Bautzen. He served as aide-de-camp to Napoleon in the Italian and Egyptian campaigns. In 1805 he was made grand-marshal of the palace, and was frequently employed in diplomatic missions, though he still took his full share in the wars of France till the time of his death. He was a great favorite of Napoleon, and was killed by his side.

DURUY (dü-rü-ē), Victor, French historian and educationalist, born at Paris 1811. He is author of History of France, History of Greece, History of the Romans, History of Ancient Greece, and History of the World. He died in 1894.

DUSE (doo′zay), Eleonora, an Italian actress born in 1859 in Piedmont. Her first great success was at Milan in 1885. In 1892 she appeared at Vienna and in 1893 she made her American debut in New York as Camille. Duse has played with great success as Juliet, Magda, Francesca da Rimini and other noted parts.

DUSSELDORF (dus′sel-dorf), a town of Prussia, in the Rhenish province, beautifully situated among villas and gardens on the right bank of the Rhine, 22 miles n.n.w. Cologne, one of the handsomest towns in the valley of the Rhine. It is a great focus of railway and steamboat communication, and has a number of handsome public buildings, and several remarkable churches. Among the public institutions particular notice is due to the Academy of Art, founded, 1767, by the Elector Theodore. The industries embrace iron, cotton, leather, tobacco, carpets, chemicals, objects of art, etc., and the trade is large. Pop. 213,767.

DUST, very small particles of various kinds of matter, vegetable, animal, and mineral, which fills the atmosphere of the earth, at least near the surface of the earth, and which may be seen in the beams of the sun when passed through a mass of air, as in a room. No localities are free from dust. It is found over the surface of the ocean, on the tops of mountains, and in the most secluded places. It consists of the pollen of plants, vegetable fibers of many kinds, hairs, and fragments of various kinds, such as metallic salts, iron, etc. There are living organisms in dust which are not revealed by the microscope except by special tests, such as their power to propogate. In this way disease germs and moulds of various kinds are scattered about, find lodging places in favorable media, and in the bodies of man and animals produce what is called disease. Dust is largely made up of volcanic matter, finely ground, and of the comminuted meteroites oxized in their swift passage through the air. It is known that dust produces rain and causes moulds.

DUST-BRAND. See Smut.

DUST COUNTER, an instrument for counting the particles of dust in the air.

A small volume of air is forced into a receptacle with a glass bottom ruled into very small squares. The air is suddenly expanded and a fog is formed which, when it settles, carries down the dust. The number of particles per square are counted and a calculation is made by which the number of particles in a cubic centimeter of air can be estimated. The instrument was invented by John Aitken.

DUST STORMS, extraordinary whirlwinds caused by the rapid rise of the air from the surface of the earth in very hot climates. They are seen in India, the Sahara Desert, and in the western part of the U. States. The vertical motion of the air sucks in the dust from the earth, dead leaves, sticks, and other objects, and carries them sometimes up to the clouds, but ordinarily only 1000 feet above the earth. In hot desert regions several of these whirls are often seen together whirling about a center like dancing pillars of sand.

DUTCH, the people and language of Holland or the Netherlands. See Netherlands.

DUTCH EAST INDIA COMPANY, a company founded in 1602, which was given a trade monopoly of the Dutch colonies in Java, and the East. It went out of existence in 1795.

DUTCH EAST INDIES, a term applied to the possessions of Holland in the Malay Peninsula. They include Java, Madura, Sumatra, part of Borneo, and other islands, the total area of which is 736,400 miles and the population 34,090,000. The total European population, numbering not more than 75,000, consists chiefly of Dutch.

DUTCH GOLD, an alloy of eleven parts of copper and two of zinc. Called also pinchbeck. See also Dutch Metal.

DUTCH METAL, an alloy containing 84·5–84·7 per cent of copper and 15·5–15·3 per cent of zinc, with a fine golden-yellow color, ductile, malleable, and tenacious. When beaten out by a process analogous to that for gold-leaf, until the sheets are less than $\frac{1}{10000}$th part of an inch thick, it constitutes Dutch leaf or Dutch foil, and is used instead of gold-leaf for ornamental purposes.

DVORAK (dvor-shäk'), Anton, a Bohemian musical composer, born in 1841. He studied at the Prague Conservatoire and at Vienna. He has composed several operas on national Bohemian subjects, a number of songs, orchestral arrangements of Bohemian dances, several symphonies, a Stabat Mater, a cantata The Specter Bride, an oratorio St. Ludmilla. Died 1904.

DWARF, a term applied to any animal or plant greatly below the usual size of its kind, particularly to a human being of small dimensions. Accounts of dwarf tribes have been common from early times, such tribes being located especially in Africa; and it would appear from the accounts of Du Chaillu, Schweinfurth, and other travelers that there are several dwarfish tribes through out this continent. The Obongo, a race of dwarfs, are described as living in woods near the Okanda river, in wretched huts made of branches. Other races are the Mabongo, and the Akka dwarfs of Central Africa; and a race is said to exist in the Congo State, not as a distinct community, however, but mixed with other tribes. Individual dwarfs occur in all races, and were formerly a fashionable appendage to the courts of princes and the families of nobles.

DWARFING, the process of training up trees or shrubs for ornament in houses so as to cause them never to reach more than a very small size, by keeping them in poor soil, giving them little water, pinching off strong shoots, etc. Practiced among the Chinese and Japanese.

DWIGHT (dwīt), Timothy, American divine, born in Massachusetts 1752, died 1817. His father was Colonel Timothy Dwight, and his mother was a daughter of Jonathan Edwards. He served as chaplain in the revoluntionary army, and ultimately became president of Yale College. His Theology (1818) was for long a standard both in Britain and in America. He was also the author of two poems, the Conquest of Canaan and Greenfield Hill, besides numerous unimportant works, consisting of dissertations, occasional sermons, etc.

DWIGHT, Timothy, an American educator and clergyman, born in Connecticut in 1828. In 1886 he was elected president of Yale, and resigned in 1899. He has written a number of valuable commentaries on biblical literature.

DWIGHT, William Buck, an American geologist, born in 1833 at Constantinople, where his father was a missionary. He has been professor at Vassar College since 1878 and curator of the museum. He has published several papers on geological subjects.

DY'AKS, the aborigines of Borneo, chiefly inhabiting the interior of the island. They are a finely-formed race, of a yellow complexion, and are described as docile, industrious, and superior to the Malays. The more advanced of them practice agriculture and dwell in neatly-constructed and tolerably comfortable houses. In Sarawak they have made considerable advances in civilization. They are mostly heathen. The practice of head-hunting (hunting their enemies to make trophies of their heads) is practiced among them, but has been abolished where European influence prevails. See Borneo.

DYAS, in geology, a name for the Permian system.

DYCK, Sir Anthony Van. See Vandyck.

DYEING is the art of fixing a new and permanent color on textile substances, usually cotton, linen, silk, and wool. Some preliminary operations are necessary in order to cleanse the stuff from any foreign matters which would prevent the dye having free access to it, as well as to remove any natural coloring which would interfere with the production of bright clear tints. Cotton and linen fabrics go through a prolonged series of operations in bleaching (which see). Silk is boiled in a solution of fine soap, to remove the fatty matter; and wool is cleansed by scouring in weak soap or soda-lye or weak ammonia.

The process of dyeing varies much according to the stuff and the coloring matters used. In general animal fibers, like silk and wool, combine more easily with most colors than vegetable fibers such as linen and cotton. In the case of the former, for example, a simple immersion in aniline dyes is sufficient to produce a fixed color. Such colors are said to be substantive, in relation to the stuffs with which they thus combine. Dyes which will not unite directly with the fibers so as to produce a good and permanent color, are termed adjective. These dyes require the intervention of another agent to fix them on the different stuffs, and the name of mordant is applied to those substances which are employed to make the stuff to be dyed and the dyeing color combine. Alum, acetate of alumina, chloride of tin, salts of iron, albumen, gluten, tannin, etc., are common mordants. The mordant is generally dissolved in water into which the stuffs to be dyed are plunged. In some cases it is mixed with the color and both are simultaneously applied to the stuff. An important characteristic of mordants is their power of affecting the natural tint of the dye and thus enabling a variety of shades to be produced at small expense. Thus nitrates tend to give a yellow tinge to the colors, alumina deepens and oxide of tin brightens the natural tints. A process of dyeing to which the name of Aero-hydraulic dyeing has been given, consists in forcing the color through the material by hydraulic pressure. The advantages of the process are that the color is forced equally through any thickness of the stuff, which thus remains bright till completely worn out.

The dye-stuffs in use at the present day are derived alike from the animal, mineral, and vegetable kingdoms. Among the most notable additions to the list of coloring stuffs within recent years are the aniline dyes of coal-tar origin (see Aniline), which yield a great variety of brilliant colors, such as magenta, mauve, aniline, purple, rosein, violine, etc. From coal-tar also the two coloring principles of madder (alizarine and purpurine) have been artificially produced. There are few organic substances which under proper treatment will not yield coloring matter, and of late new coloring matters have been obtained from wood-sawdust, lichens, mosses, paper and cotton waste, bran, starch, sugar, soot, etc.

DYE-STUFFS. See Dyeing.

DYING DECLARATION. (See Declaration, Dying.)

DYKE. See Dike.

DYNAM'ETER, an instrument used for measuring the magnifying power of telescopes. It consists of a small compound microscope, with a transparent plate, exactly divided, which is fixed to the tube of a telescope, in order to measure exactly the diameter of the distinct image of the eye-glass. Also same as Dynamometer.

DYNAM'ICS is the science which deals with the laws of force in their relation to matter at rest or in motion, and as such it is differentiated from kinematics, which considers motion mathematically, and apart from the forces producing it. It is to Newton that we owe the clear statement of the three primary laws of force. These are: (1) that every body remains in a state of rest, or of uniform motion along a straight line, unless it is

compelled by force to change that state. (2) That change of motion is in proportion to the force employed, and occurs along the straight line in which the force acts. This change of motion includes both change of rate and of direction. (3) That, as the result of every action, there is also and always an equal reaction. These laws, which were formulated from experiment, involve the conception of force as a primary influence or action expressed in terms of space, time, and matter. Now, in dealing with the laws of force, a standard of measurement is required which shall be applicable to all forces at all times, and we therefore require to begin by establishing units of space, time, and mass. There are two systems of units in use, the one British, the other French. In the British system the foot is taken as the unit of length, and the second as the unit of time. In the French the centimetre is the unit of length, the second the unit of time; the unit velocity in the one case being that of one foot per second, in the other one centimetre per second. The British unit of mass is the pound (the mass of a certain lump of platinum deposited in the exchequer office, London); the French the gramme; and accordingly the French units of space, mass, and time are commonly known as the C.G.S. (centimetre, gramme, second) units. As the weight of a pound (or a gramme) is not the same at all parts of the earth's surface it cannot give us of itself an absolute or dynamical unit of force, that is, an invariable unit; but taking it in conjunction with unit time and unit velocity, we do obtain such a unit. Two absolute units of force are in common use in dynamics, the poundal and the dyne; the latter being the absolute unit in the C.G.S. system. The former is that force which, acting on the mass of one pound for one second, generates in that mass a velocity of one foot per second. The latter is that force which, acting on the mass of one gramme for one second, generates in that mass a velocity of one centimetre per second. It is important in dynamics to distinguish between mass and weight. The mass of one pound is the quantity of matter equal to a certain standard quantity (a certain lump of metal) and is quite independent of force. The weight of one pound is the force with which the mass of one pound is attracted to the earth's surface by the force of gravity. Another important term is momentum; the momentum of a body in motion at any instant is the product of the mass of the body and the velocity at that instant. Dynamics is divided into two great branches: statics, which treats of solid bodies at rest under the action of forces; and kinetics, which treats of the action of forces in producing motion in solid bodies. Formerly the latter alone was called dynamics, and to this, in conjunction with statics, the general name mechanics was given. In the wide sense dynamics includes also hydrostatics.

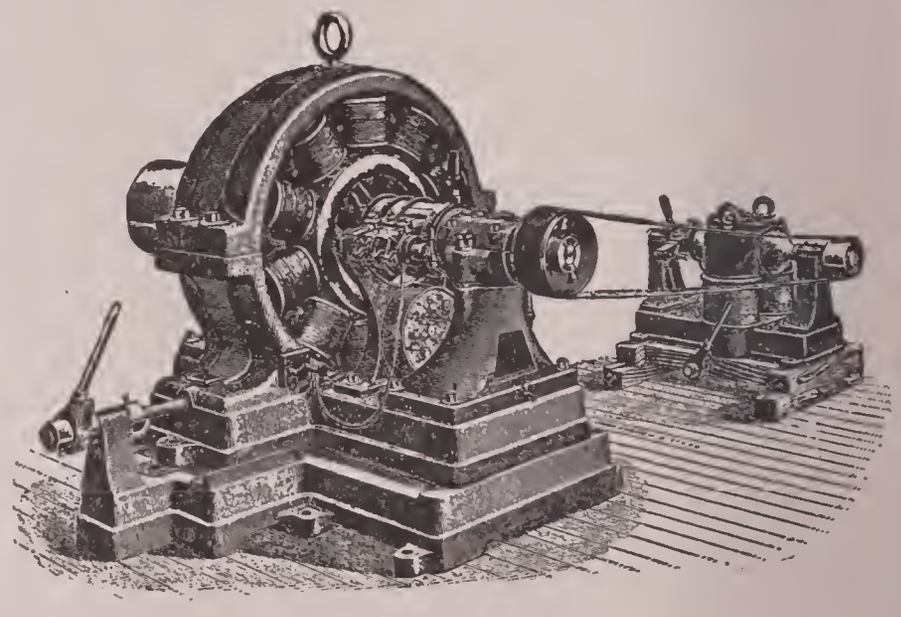
DYNAMIC THEORY, a theory explanatory of the essential constitution of matter. In the dynamic theory every body is considered as a space filled with continuous matter; porosity then becomes an accidental quality, but compressibility and dilatability essential properties. The state of a body depends entirely on certain attracting and repelling forces; and its volume must change with every change in the relative proportions of these forces. It is opposed to the atomic theory, which supposes every body to be composed of indivisible and impenetrable particles termed atoms. These are almost infinitely small, with void spaces between them, so that this theory makes porosity essential to matter.

DY'NAMITE, an explosive substance patented by A. Nobel in 1867. As originally made it consists of a siliceous earth obtained at Oberlohe in Hanover and known as kieselguhr, impregnated with 75 per cent of nitro-glycerine (see Nitro-glycerine), the object of the mixture being to facilitate the carriage and use of the substance by diminishing its susceptibility to explode by shock while not destroying its explosive force. The siliceous matter is of diatomaceous origin; it is extremely friable and porous, and has a considerable absorbent power. Dynamite thus prepared has the appearance of raw sugar. Diatomite, a substance superior to kieselguhr, is now also employed, and various other substances have been used to mix with the nitro-glycerine, such as charcoal, sand, saw-dust, etc. The mixture remains without change for any length of time, unless exposed to water. It burns away quietly if a light is applied to it, but explodes if heated to a high temperature. Usually it is exploded by a specially arranged fulminating cap. Its explosive force is several times that of gunpowder, which it has largely superseded for blasting.

DYNAMO, an electro-magnetic device for the production of electricity, which serves either as a generator or a motor. For example, the motor of a trolley car is a dynamo in all essentials the same as the dynamo at the power house which generates the current.

In an electric generator mechanical energy is converted into electrical energy by means of continuous relative motion between electrical conductors and a magnetic field, or fields, such motion causing the conductors to cut or traverse the lines of force of the fields. In an electric motor electrical energy is transformed into mechanical energy by means of continuously supplying a system of electrical conductors with an electric current, which causes a magnetic force to act between the conductors carrying it and the magnetic field, or fields, thereby producing continuous relative motion between the conductors and the magnetic fields.

The preceding definitions are general and necessarily technical. To comprehend them fully a knowledge of the fundamental principles involved in the operation of dynamo-electric machines is necessary. They may, however, be in a measure elucidated by a descriptive definition as follows: All generators consist essentially of one or more electro-magnets between the poles of which an armature, consisting of a soft iron core wound with coils of insulated copper wire, is made to revolve very rapidly by means of a steam-engine, a water-wheel, or other prime mover. In the transmission of energy by electricity the current produced by the generator is made to pass through another machine, similar and often identical in construction, and there causes the armature to revolve, and this revolution may be employed to do any kind of mechanical work. This second machine, working in reverse order from the first, is an electric motor. This description makes it clear, as do the preceding definitions, that to understand thoroughly the dynamo-electric machine requires a knowledge of three great branches of science—magnetism, electricity, and mechanics. The necessity for this special knowledge makes the subject of dynamo-electric machines a difficult one to discuss in familiar terms.



Dynamo.

DYNAMOM'ETER, any instrument for measuring the relative strength of men or animals, or the force of machinery. Commonly it consists of a

spiral spring suitably applied. When the pull upon a draft implement, as a plow for instance, is the point to be determined, the dynamometer is made a link in the draft-chain, and the amount of extension or collapse which it suffers indicates the intensity of the strain.

DYS'ENTERY, a dangerous disorder of the intestines, known by fever; frequent griping stools; tenesmus; stools chiefly mucous, sometimes mixed with blood, the natural feces being retained, or voided in small, compact, hard masses; loss of appetite and nausea. It may be occasioned by a sudden check in the perspiration, or the use of unwholesome and putrid food, or by noxious exhalations and vapors, and it is often the result of a specific contagion. When the symptoms run high, produce great loss of strength, and are accompanied with a putrid tendency and a fetid and involuntary discharge, the disease often terminates fatally in a few days. In some cases the febrile state wholly disappears after a time, while the proper dysenteric symptoms may be of long continuance. Hence the distinction into acute and chronic dysentery. Saline purgatives, and for severe cases laudanum (20 or 30 drops) or Dover's powder, are useful. The endemic dysentery of Egypt is a distinct disease caused by the presence of a worm in the intestines.

DYSMENORRHŒ'A, a disease of women, consisting in painful or difficult menstruation, which may be caused in various ways.

DYSPEP'SIA, difficulty of digestion. The action of the stomach on the food is that usually designated as digestion, and it is the derangement of this process that is usually expressed by the term dyspepsia. This derangement may be caused by disorders of a very various and even opposite character. The subacute and chronic forms of gastric irritation and inflammation are the most common forms of dyspepsia, and are often caused by too highly-seasoned or too abundant food and stimulant drinks, or by the improper use of emetics, tonics, or stimulants. Another class of dyspeptic diseases is connected with irritation of the mucous membrane of the duodenum, causing perversion of secretions and disorder of functions. A third class of dyspeptic diseases depends on the nerves connected with the digestive viscera. Hence arises an order of dyspeptic symptoms independent of any immediate affection of the stomach.

Dyspepsia is therefore not a disease of a uniform character, but is rather attached as a symptom to a variety of diseases. The most common cause of dyspepsia are excesses of various kinds, especially in the quantity of food eaten. Persons of a sedentary life require less nutriment than those of active habits. Exercise and the quantity of food to be digested must be proportioned to each other. The quality of food as well as its quantity has to be considered. Good cookery, which renders the food tender and pulpy, is one preservative against dyspepsia. Tough and badly-dressed meats, crude vegetables, hot bread and cakes, and the daily use of hot tea or coffee for breakfast, are among the numerous causes of this ailment.

DZOUNGARIA, a Chinese territory in Central Asia, stretching from about 43° to 48° n. lat. and from about 82° to 86° e. lon. It has an area of 147,950 sq. miles, and pop. 600,000. It is administratively connected with Kuldja, and since the surrender of Kuldja by the Russians in 1880 is again under Chinese rule. Dzoungaria, once the center of an independent empire, was first conquered by the Chinese in 1757.

E

E, the second vowel and the fifth letter of the English alphabet. It occurs more frequently in English words than any other letter of the alphabet. Its long or natural sound in English coincides with the sound of i in the Italian and French languages, as in here, mere, me. It has also another principal sound, a short one, heard in met, men. It has besides a sound like a in bare, as in there, where, etc., and the obscure sound which is heard in her. As a final letter in English it is generally silent, but it serves to indicate that the preceding vowel is to have its long sound, as in mane, cane, plume. When two e's come together the sound is generally the same as that of the single e long, as in deem, esteem, need (comp. however pre-exist, etc.).

E, in music, is the third note or degree of the diatonic scale, answering to the mi of the Italians and French.

EADS, James Buchanan, an American civil engineer and inventor, born in Indiana in 1820, died 1887. He removed to St. Louis in 1833 and figured in the civil war as an adviser of Lincoln in the matter of ironclads. In 1867 he began his famous work on the great Eads bridge at St. Louis, and 1874 undertook the construction of the jetties at New Orleans, by which the channel of the Mississippi river was deepened. The latter years of his life were spent in engineering works abroad.

EAGLE, the general name of raptorial birds that form a group of the great family Falconidæ, which includes the eagles, falcons, and hawks. The eagle is popularly regarded as the noblest and most courageous of the rapacious birds. It soars to a greater height than any other bird, from which circumstance the ancients considered it as the bird or

Bald eagle.

messenger of Jove. The genus Aquila

Golden eagle.

which includes the most typical eagles, is distinguished by its long and powerful bill, the curve commencing at the cere, by its wings reaching to the tip of the tail, and by its tarsi being feathered to the toes. The imperial eagle of Centra Europe is probably the species to which the popular belief in the courage, strength, and nobleness of eagles is to be traced. The golden eagle, is the chief British species. It measures over 6 feet from tip to tip of the expanded wings,

Imperial eagle.

and 3 feet from the beak to the end of the tail. The adults have the body brownish, becoming darker with age; the feathers of the head and neck pointed and of a golden-red hue. This species is found all over the northern hemisphere. The bald eagle, found in N. America and northeast Asia, is the symbol of the U. States. Like all members of the genus his diet is less restricted than that of the true eagles; and he even takes carrion. Another eagle, the serpent eagle, or short-toed eagle, ranges through south-

ern Europe, Asia, and especially North Africa. In structure and habits this bird approaches the buzzards.

EAGLE, as a symbol. The eagle first appears as a war standard among the Persians, through whom it reached the Egyptians. As the standard of the Roman armies it was first used by Marius, and latterly took the place of all the

Roman eagles.

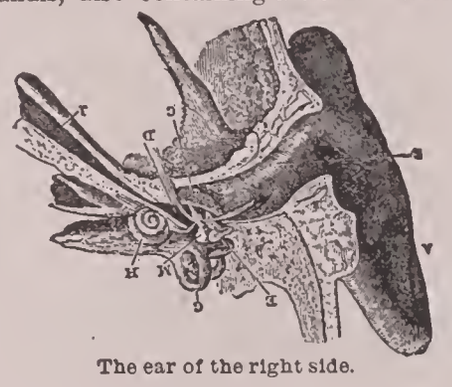
other emblems at the head of the legions. In the mediæval ages the eagle became the heraldic emblem of the old German Empire, and was made double-headed in the 14th century. When the old German Empire ceased the double-headed eagle was retained by Austria. A double-headed eagle is also the national military symbol of Russia, as a single-headed eagle is that of Prussia and the United States of America; the latter stands with outspread wings guarding a shield, with the motto E Pluribus Unum. The eagle is also the badge of several orders, the chief of which are the order of the Black Eagle, founded in 1701, and the highest order in Prussia; the order of the Red Eagle, also a Prussian order and founded in 1705; the Russian order of the White Eagle, originally Polish, and instituted in 1325.

EAGLE, a gold coin in the U. States of the value of ten dollars, first coined in 1795. There are also half-eagles, quarter-eagles, and double-eagles.

EAGLE-OWL, a name for several large horned owls, little inferior in size to the golden eagle, found in many parts of Europe and sometimes in Britain. An allied species, the Virginian horned owl is common in the U. States.

EAMES, Emma (Mrs. Julian Story), an American opera singer, born in 1867 in China, where her father was engaged in law. Her studies were made in Boston and in Paris (under Marchesi). In 1889 she made her first appearance in Faust and at once took her place among the great soprano singers of the time. Madame Eames has sung in Europe and the U. States in all the most difficult grand operas.

EAR, the organ of hearing. It is situated at the side of the head, and in the higher vertebrates is divided into the outer, middle and inner ear. The external ear, which is a cartilaginous funnel for collecting the sound waves and directing them inward, is composed of the pavilion, or projecting part, and of the auditory canal, which extends from the concha, or central hollow of the pavilion, to the membrane of the tympanum or drum. This membrane is a partition stretched obliquely across the bottom of the auditory canal, which it separates from the middle ear or drum; it is semi-transparent and very delicate. It vibrates with the waves of sound which strike against it, and transmits the vibrations to certain little bones of the cavity of the tympanum. These bones, which have been named respectively the hammer (malleus), the anvil (incus), and the stirrup (stapes), transmit the vibrations to the internal ear, forming a chain communicating at one end with the membrane just mentioned, and at the other with the inner ear. The internal ear consists of a bony cavity called the vestibule, three semicircular canals, and a bony structure in the form of a spiral shell, called the cochlea. The vestibule communicates with the tympanum, the cochlea, and the semicircular canals, and is entered by branches of the nerve of hearing. The various parts of the internal ear, which together form the osseous labyrinth, are lodged in the hardest part of the temporal bone; they are lined throughout with a very thin membrane, and are full of a very thin and limpid fluid. They contain a structure of corresponding form called the membranous labyrinth, consisting of sacs and canals, also containing a fluid. With-



The ear of the right side.

in the membranous canal of the cochlea is lodged the complicated apparatus which is believed to be the chief agent in the perception of sound. The middle ear communicates with the throat and pharynx by the Eustachian tube, through which air from the mouth may be pressed against the membrane of the drum. In the external auditory canal of the ear is produced the cerumen or ear-wax, which if allowed to accumulate may cause deafness. The cut shows a the pavilion, b the external canal, c the drum membrane partly removed, d cavity of middle ear, e anvil and m hammer, the small bones communicating with the drum and vestibule, h cochlea, g semi-circular canals, i Eustachian tube.

EARL, a degree of the British nobility between marquis and viscount, the title of highest antiquity in England. The title was made hereditary by William the Conqueror, and for a time was used interchangeably with that of count, the corresponding title on the Continent. The wife of an earl is still called a countess. An earl's coronet is composed of eight pearls raised upon points, with small leaves between, above the rim. See Coronet.

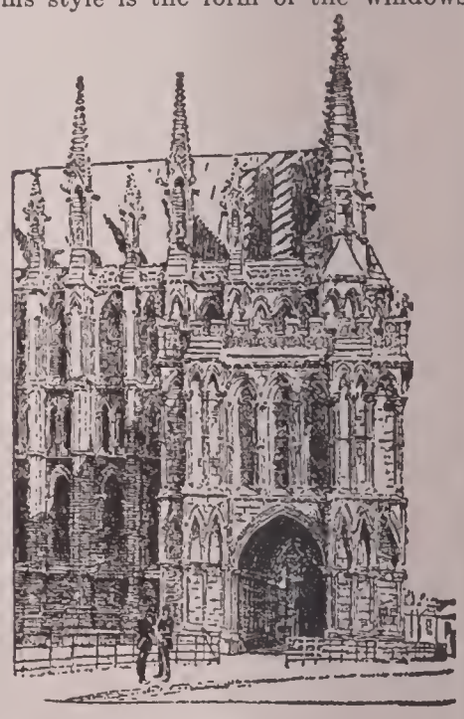
EARLSTON, a village of Scotland in Berwickshire. Near it are the ruins of the ancient tower, which belonged to the famous Thomas the Rhymer. Pop. 1060.

EARLY, Jubal Anderson, an American confederate general, born in Virginia in 1816, died in 1894. He graduated at West Point fought in the Mexican War, joined the confederate forces in 1861, fought at Bull Run, Williamsburg, Antietam, and other important battles of the civil war. Subsequently to the war general Early practiced law and was distinguished for being the most prominent of the "unreconstructed rebels." He never took the oath of allegiance to the U. States and died a confederate. He published several interesting memoirs.

EARLY ENGLISH ARCHITECTURE, the first of the Pointed or Gothic styles of architecture that prevailed in England. It succeeded the Norman in the reign of Richard I. (1189), and continued to the end of the reign of Henry II. in

Early English capital, Salisbury.

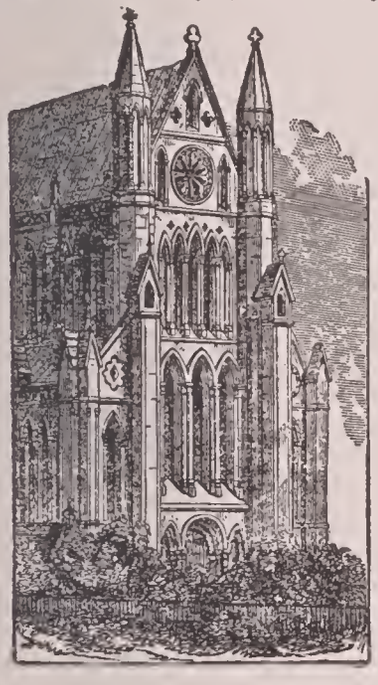
1272, a period of 123 years, when it gradually merged into the Decorated style. One of the leading peculiarities in this style is the form of the windows,



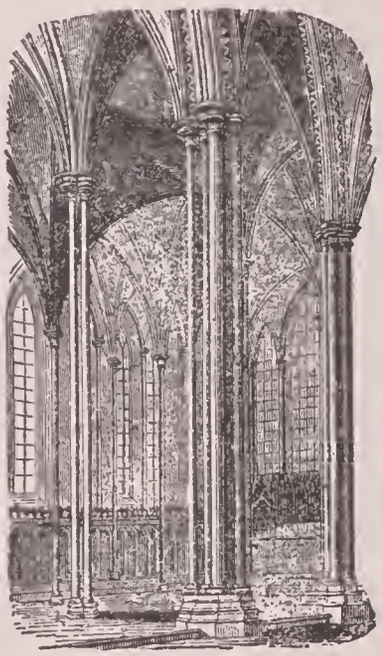
Early English architecture—Galilee porch and south transept of Lincoln cathedral.

which are narrow in proportion to their height, and terminate in a pointed arch, resembling the blade of a lancet. Throughout the early period of the style they are very plain, particularly in small churches; but in cathedrals and other large buildings the windows, frequently combined two or more together, are car-

ried to a great height, are richly and deeply molded, and the jambs ornamented with slender shafts. Though separated on the outside, these lancets are in the interior combined into one design, thus giving the first idea of a compound window. The doorways are in general pointed, and in rich buildings sometimes double; they are usually molded, and enriched with the tooth-ornament. The buttresses are often very bold and prominent, and are frequently carried up to the top of the building with but little diminution, and terminate in acutely-pointed pediments, which, when raised above the parapet, produce in some degree the effect of pinnacles. In this style, likewise, flying-buttresses were first introduced, and the buttresses themselves much increased in projection owing to the comparative lightness of the walls, which required some counter-support to resist the outward pressure of the vaulting. The roof in the Early English style appears always to have been high pitched, and the towers surmounted by lofty pointed spires, as at Salisbury cathedral. In the interior the arches are usually lancet-shaped, and the pillars often reduced to very slender proportions. As if to give still greater lightness of appearance, they are frequently made up of a center pillar, surrounded by slight detached shafts, only connected with the pillar by their capitals and bases, and bands of metal placed at intervals. The architects of this style carried their ideas of lightness to the utmost limits of prudence, and their successors have been afraid to imitate their example. The abacus of the capitals is generally made up of two bold round moldings, with a deep hollow between. The foliage is peculiar, generally very gracefully drawn, and thrown into elegant curves; it is usually termed stiff-leaved, from the circumstances of its rising with a stiff stem from the neck-mold of the capital. The trefoil is commonly imitated, and is very characteristic of the style. The moldings of this style have great boldness, and produce a striking effect of light and shade. They consist chiefly of rounds separated by deep hollows, in which a peculiar ornament, called the dog's-tooth, is used, whenever ornament can be introduced. This ornament is as characteristic of the Early English as the zig-zag is of the Norman.



Early English style—North-west transept of Beverly minster.



Early English style—Detached shaft in Lady Chapel, Salisbury cathedral.

EAR-RING, an ornament for the ear, consisting of a ring or hook passing through the lobe, with a pendant of diamonds, pearls, or other jewels frequently attached. Ear-rings were commonly worn among the Oriental nations, and by both sexes, from the earliest times. Among the Greeks and Romans they were not so commonly worn by men as by women. In England the Romanized Britons and the Anglo-Saxons wore them, but the fashion declined in the 10th century, and was again introduced in the 16th century, in Queen Elizabeth's time.

EARTH, the planet which we inhabit, a nearly spherical body which every twenty-four hours rotates from west to east round an imaginary line called its axis—this axis having as its extremities the north and south poles respectively—while in the course of a year it completes a revolution round the sun. To an observer whose view is not obstructed any part of the earth presents itself as a circular and horizontal expanse, on the circumference of which the heavens appear to rest. Accordingly, in remote antiquity, the earth was regarded as a flat, circular body, floating on the water. But even in antiquity the spherical form of the earth began to be suspected. It is only on this supposition that we can explain how the horizon of vision grows wider and wider the higher the position we choose, how the tops of towers and mountains at a distance become visible before the bases, how the hull of a ship first disappears as she sails away, and how, as we go from the poles toward the equator, new stars become visible Besides these proofs there are many others, such as the circular shadow of the earth seen on the moon during an eclipse, the gradual appearance and disappearance of the sun, and, lastly, the fact that since 1519 it has been regularly circumnavigated.

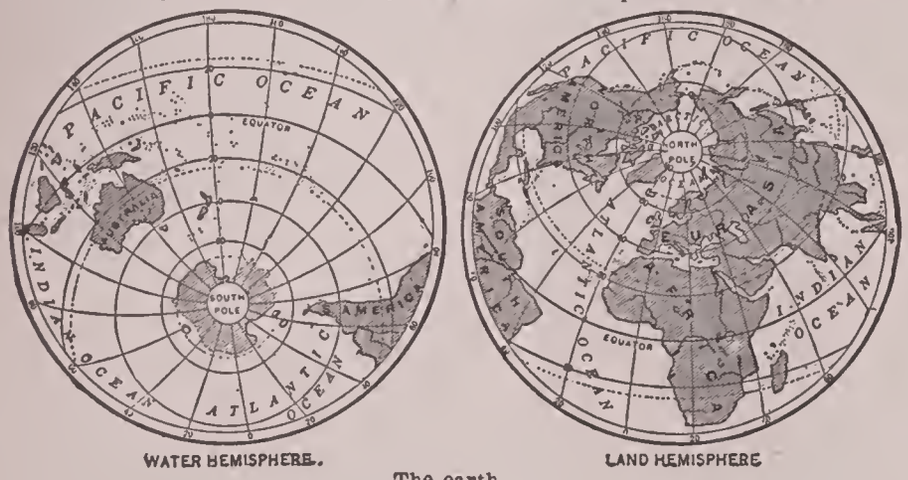
The earth is not, however, an exact sphere, but is very slightly flattened at the poles, so as to have the form known as an oblate spheroid. In this way the polar diameter, or diameter from pole to pole, is shorter than the diameter at right angles to this—the equatorial diameter. The most accurate measurements make the polar diameter about 27 miles less than the equatorial, the equatorial diameter being found to be 7925·6 miles, and the polar 7899·14 The earth is regarded as divided into two halves—the northern and the southern hemisphere—by the equator, an imaginary line going right round it midway between the poles. In order to indicate with precision the position of places on the earth additional circles are imagined to intersect one another on the surface in such a manner that those of the one set all pass through both poles, while those of the other are drawn parallel to the equator. The former are called meridians, the latter parallels of latitude and by them we can tell the latitude and longitude, and thus the exact position of any place.

Many experiments by various methods have been made in order to determine the average density of the earth, that is, the quantity of matter it contains. Among these methods may be mentioned: (1) that of determining the attraction of a mountain on the direction of a plumb-line and calculating from thence the density of the earth; (2) that founded on the difference of oscillation in a pendulum when placed at the summit of a mountain and when at the sea-level; (3) the converse of the preceding method, by the determination of the difference of gravity at the top and the bottom of a deep mine, by pendulum experiments; (4) Cavendish's experiment with the torsion balance, which attempts to compare the attractive force of two large lead balls over other two small lead balls with that exercised by the earth. From these and other experiments it has been calculated, taking the mean of all results, that the density of the earth is to that of water as 5·639 to 1.

The earth, in common with the other planets, moves round the sun, completing its revolution in about 365 days and six hours, and thus forming our common year. The orbit of the earth is an ellipse, with the sun in one of its foci. Hence the earth is not equally distant from the sun in all parts of the year; being about 3,000,000 miles nearer at one time than another, its least distance (perihelion distance) according to recent calculations being 89,897,000 miles, its greatest (aphelion distance) 92,963,000, and the the mean distance, or half the length of the long axis of the orbit, 91,430,000 miles. From this it may be calculated that the velocity of the earth in its orbit is about 17 miles a second. In winter (speaking of the northern hemisphere) the earth is nearest the sun and in summer farthest from it; for the difference

in the summer and winter temperature is not occasioned by the greater or less distance of the earth from the sun, but by the more or less oblique direction of the sun's rays. The passage of the earth round its orbit causes the sun to appear as if it described a similar orbit in the heavens; and hence it is that at one time of the year one group of stars is seen in the neighborhood of the sun at sunrise and sunset and at another time another group. This apparent path of the sun is the ecliptic, and corresponds with what would be the path of the earth as seen from the sun; and the groups of stars through which the sun successively passes form the zodiac.

The earth's daily motion about its own axis takes place, according to mean time, in twenty-three hours, fifty-six



The earth.

minutes, and four seconds. This diurnal revolution is the occasion of the alternation of day and night. As the axis on which the earth performs its diurnal rotation forms with the plane of its path about the sun an angle of 23½° (which angle also represents that between the plane of the ecliptic and the plane of the earth's equator), the sun ascends in the heavens, from March 21 to June 21 (the summer solstice), about 23½° above the equator toward the north pole, and descends again toward the equator from June 21 to September 23; it then sinks till December 21 (the winter solstice), about 23½° below the equator, toward the south pole, and returns again to the equator by March 21. This arrangement is the cause of the seasons, and the inequality of day and night attending them. For all countries lying beyond the equator, day and night are equal only twice in the year (at the equinoxes). At the summer solstice the north pole of the earth is turned toward the sun, and the south pole away from it, and for 23½° round the former there is a period of longer or shorter duration during which the sun is continually above the horizon for more than 24 hours, while round the latter there is an equal extent of surface within which the sun for similar periods is below the horizon. (See Day.) The reverse state of matters occurs at the winter solstice. The circles bounding these regions are called respectively the arctic and the antarctic circle, and the regions themselves the polar or frigid zones. Throughout a region extending to 23½° on each side of the equator the sun is directly overhead at every point in succession twice in the year. The circles which bound this region are called the tropics, that in the northern hemisphere being the tropic of Cancer, that in the southern the tropic of Capricorn, while the region between is the torrid zone. The regions between the tropics and the polar circles are respectively the north and south temperate zones.

From the evidence furnished by volcanoes, hot springs, sinking of mines, etc., it is known that the earth has a high internal temperature of its own. Taking the average of the various observed rates of increase this temperature seems to increase 1° Fahr. for every 60 feet of descent. Assuming this to continue, the rocks at a depth of 2 miles would be as hot as boiling water, and at a depth of 50 miles the heat would be such as at the surface would melt every known solid. This being so, various theories as to the internal condition of the earth have been proposed: (1) That a thin envelope or crust surrounds a molten interior. It can be shown, however, that as tides must be produced in such a molten mass the cool outer crust would be unable to withstand the enormous force of these unless it were about 2000 miles thick. (2) That the interior is solid, with spaces here and there filled with liquid or gaseous material. This theory assumes that there are within the earth enormous cavities filled with molten rock, which escapes when local pressure is removed in the form of volcanic outbursts. (3) That the earth consists of a thin crust, a large solid nucleus, and a liquid film between the nucleus and the crust; the temperature at the center being not much greater than comparatively near the surface. (4) That the earth is solid to the center, but any part may become liquid if local pressure is removed. We know that if the pressure on a solid be increased the melting point is correspondingly raised; now the pressure at the center of the earth, or even at the depth of 50 or 100 miles, must be something enormous, and probably is so great as to keep the rocks there permanently in a solid condition, notwithstanding the heat. This last theory is considered the most probable. On the supposition of its correctness volcanoes might be explained by supposing that at certain points here and there pressure is removed by the elevations of portions of the earth's surface which are constantly taking place, and that this allows the rocks to liquefy. Water may then soak down to these liquid rocks, and being converted into steam produce the various volcanic phenomena.

The earth (like the other planets) is believed to have condensed and solidified from a gaseous or nebular condition, and to have once had a far higher temperature than now. If such were the case the outer surface, losing heat by radiation, would be the first part to cool quickly; while the interior, losing its heat by conduction, would not cool so rapidly, and therefore would naturally have a higher temperature than the portion at the surface. This is what all observations indicate the condition of the earth to be, and the shape of the earth also indicates that it must once have been in a fluid state. Even the time at which it was in the fluid state has been roughly calculated by Sir W. Thomson (Lord Kelvin), whose estimate makes it about 200 millions of years ago. See Nebular Hypothesis.

Another feature that the earth as a whole presents is its magnetism. When a magnetic needle is balanced on a point it remains at rest in one position only, pointing then nearly due north and south. This can be explained only on the supposition that the earth acts as a great magnet. It has in fact two poles—a north and a south magnetic pole—which are not very far from, but by no means coincident with, the geographical poles. There is also a neutral line or magnetic equator, which does not greatly diverge from the geographical equator. The earth acts upon all magnets as they act upon each other, and it is for this reason that they point north and south.

The surface of the earth contains over 196,000,000 square miles, of which scarcely a third-part is dry land, the remaining two-thirds being water. The land is arranged into masses of irregular shape and size, the greatest connected mass being in the eastern hemisphere. The chief masses receive the name of continents, detached masses of smaller size forming islands. The surface of the land is variously diversified, exhibiting mountains, valleys, plains, plateaux, deserts, etc. The water area of the earth is divided into oceans, seas, bays, gulfs, etc., while rivers and lakes may be regarded as features of the land surface. The great phenomena of the oceans are currents and tides. The population of the whole earth is estimated at from 1350 to 1450 millions. The earth is attended by the moon as a subordinate or subsidiary planet. See also such articles as Climate, Currents, Ocean, Earthquake, Seasons, etc.

EARTH-CURRENTS, violent electrical disturbances of the nature of transient currents, which rush in one direction or the other, and by which telegraph lines, and particularly long submarine lines, are constantly troubled. Their origin and nature are not thoroughly understood, but they are found to be very intimately connected with the perturbations of terrestrial magnetism called magnetic storms, and

these, it is well known, are closely connected both with the appearance of the aurora borealis and with the occurrence of the sun's spots.

EARTHENWARE, a name applied to the more common sorts of pottery-ware. The older kinds of earthenware, such as Majolica, Delft-ware, Faience, and Palissy-ware are not only glazed, but are besides elaborately colored and enameled and ornamented with raised figures of various kinds.

EARTHQUAKE, a shaking of certain parts of the earth's surface, produced by causes not perceivable by our senses. This motion occurs in very different ways, having sometimes a perpendicular, sometimes a horizontal undulating, and sometimes a whirling motion. It also varies much in degrees of violence, from a shock which is hardly perceptible to one which bursts open chasms and changes the appearance of the ground itself. During these shocks sometimes smoke and flames, but more frequently stones and torrents of water are discharged. There is little doubt that earthquakes and volcanic eruptions are kindred phenomena, the latter differing from the former principally in proceeding from a permanent crater. All observations go to prove that both are due to disruptions produced by internal heat at a great depth beneath the surface of the earth. Of the particular way in which this force works, however, there are various theories. It has been thought by some that the center of earthquakes and volcanic disturbances is always near the sea or other large supplies of water, and that the disturbances are directly caused by the filtration of the water down to igneous matter, and the consequent generation of vast quantities of steam which frees itself by explosion. Others have sought to explain earthquakes as part of the phenomena of a planet cooling at the surface. The steady contraction of matter caused by the decay of heat would be likely to produce large cavities with an increasing tension of the neighboring strata till a tremendous subsidence involving convulsions reaching to the earth's surface removed the strain. The most remarkable earthquakes of modern times are those which destroyed Lima, in 1746, and Lisbon in 1755; still more recent are the earthquakes that visited Calabria in 1857, Peru and Ecuador in 1868, the island of Ischia in 1884, Charleston and that district of the United States in 1886, Mentone and the Riviera of Italy in 1887.

The great earthquake which destroyed San Francisco (see San Francisco) was connected, it is believed, with the recent disastrous eruption of Vesuvius (see Vesuvius) and with the earthquake all along the coast of South America on August 5, 1906, and following, in which 200 people were killed, and Valparaiso, Chile, was almost destroyed, with a loss of $2,000,000 of property, none of which was insured.

Measured by the immediate destruction of human life and of property and the resultant misery and suffering to human beings yet alive, the earthquake of December 28, 1908, in Sicily and Calabria was the most direful calamity in the world's history. Two hundred thousand lives and more than $1,000,000,000 worth of property—these figures tell the terrible story of Italy's misfortune and grief. The cities of Messina and Reggio, the former in Sicily and the latter on the mainland almost opposite, with their combined population of 170,000 were almost entirely destroyed. These cities and a number of smaller towns in the immediate vicinity were, in less than five minutes, crushed to heaps of smoking ruins.

Sicily and Calabria have always been known to be in the so-called earthquake belt. This region has been much studied by seismologists, and this latest convulsion has revived the speculation as to the cause of earthquakes. Volcanic activity on the part of Etna, Vesuvius and Stromboli was looked for at the time of the shock, but no serious eruption actually occurred. All of the seriously entertained theories of earthquake causes have been advanced to explain the shocks in southern Italy, for there were many minor shocks after the first great one, not only in Italy, but in Austria and Turkey as well. The most generally accepted theory is that an earthquake is the result of a "fault" in the geological formation under the affected region, in this case the fault constituting a line of contact between the volcanic strata underlying Mt. Etna and Mt. Vesuvius. It is believed that the strata underlying the Strait of Messina slipped along the line of this fault, and that the so-called tidal wave resulted from this rapid and radical altering of the sea's bed. In support of the theory now widely held that earthquakes are generally caused by the seeping of vast quantities of water into the earth's hot interior, resulting in the formation of gas and steam, it has been pointed out by Professor Milne, perhaps the greatest living authority on seismology, that an analysis of more than 10,000 observations in Japan shows that by far the greater number of earthquakes originated beneath the ocean or along the seaboard, "and as they radiated inland they became more and more feeble until on reaching the backbone of the country, which is drilled by numerous volcanic vents, they were almost imperceptible." Another idea is that the quiet, ceaseless work of the world's great rivers in carrying to the ocean sand and mud in immense quantities gradually alters the center of gravity of the globe and causes a shift in the direction of the axis. Many physicists agree with Prof. Percival Lowell, the eminent astronomer, in the contention that the earth is rapidly aging and that it is the wrinkling and consequent shrinking of the "skin" of the planet which is really the primary cause of earthquakes.

EARTHS, a term applied to certain tasteless, inodorous, dry, uninflammable substances of a moderate specific gravity, which constitute by far the greatest part of the gravel and soil that go to make up the mountains, valleys, and plains of our globe. They include lime, baryta, strontia, magnesia, alumina, etc. The earths were regarded as simple bodies until Sir H. Davy proved them to be compounds of oxygen with metals.

EARTH-SHINE, in astron. a name given to the faint light visible on the part of the moon not illuminated by the sun, due to the illumination of that portion by the light which the earth reflects on her. It is most conspicuous when the illuminated part of the disc is at its smallest, as soon after new moon. This phenomenon is popularly described as "the old moon in the new moon's arms."

EARTHWORM, a genus of common worms. They have a long, cylindrical body, divided by transverse furrows into numerous rings. The mouth is destitute of teeth, and they have no eyes, tentacles, or cirrhi. They are hermaphrodite. The common earthworm attains nearly a foot in length. It subsists on roots, woody fibers, animal matter, etc. It moves by the contractions of successive parts of the body aided by a double row of bristles. They are of great service to the agriculturist by loosening the soil and increasing its depth. This is chiefly the result of their mode of nourishment, since they deposit the soil they have swallowed, after digestion, in heaps called worm castings which bring up rich fine soil to the surface, gradually covering the upper layer sometimes to the extent of several inches.

EAR-TRUMPET, an artificial instrument for aiding the collection of the vibrations or waves of sound, and carrying them in an intensified form to the internal parts of the ear.

EARWIG, a common orthopterous insect whose name is derived from its supposed habit of insinuating itself into the ears of persons. This is practically impossible, yet the notion is widely spread. Much damage is sustained by gardeners from the depredations of these insects among fruit and tender vegetables, which constitute their proper food. The earwig is about three-quarters of an inch in length, having the wings folded under very short and truncate elytra or wing-cases, and the extremity of the abdomen armed with a horny forceps.

EASEL (ē′zel), the frame on which an artist supports his canvas. It is usually made to fold up after use.

EASEMENT, in law, a right or privilege which one proprietor may have to use the land of another in connection with the needs of his own land, as the use of a way, a water-course, etc. The right to an easement may be acquired either by grant or by uninterrupted enjoyment for a period of years.

EAST, one of the four cardinal points, being the point in the heavens where the sun is seen to rise at the equinox, or the corresponding point on the earth; that point of the horizon lying on the right hand when one's face is turned toward the north pole.

EASTER, the festival commemorating the resurrection of Christ, observed in the Roman Catholic, the Greek, Anglican, Lutheran, and other branches of the Christian church. By the first Christians it was considered to continue

the feast of the passover, at which the paschal lamb, a type of Christ, was sacrificed. Hence its name in Greek (pascha), French (pâques), and other Romance languages is taken from the Hebrew pesach, passover. The English name comes from the Anglo-Saxon Eostre, a goddess of light or spring, whose festival was celebrated in April. There was a long dispute in the Christian church as to the proper time for holding Easter, the Christians of the East celebrating it on the same day as that on which the Jewish passover fell, that is, the 14th of Nisan (hence they were called quarto decimani), while the majority of the church celebrated it on the Sunday next after this day. The controversy was decided by the Council of Nice (Nicæa) in 325, which settled that it was to be reckoned as at present, namely, that Easter is the first Sunday after the full moon which happens upon or next after the 21st of March, and if the full moon happens on a Sunday, Easter-day is the Sunday after, but, properly speaking, for the "full moon" in the above the "fourteenth day of the moon" should be substituted.

EASTERN ARCHIPELAGO. See Malay Archipelago.

EASTERN CHURCHES, a collective term for the Greek, Armenian, Coptic, Abyssinian, Syrian, and other kindred churches.

EASTERN EMPIRE. See Byzantine Empire.

EASTERN QUESTION, the name given to the diplomatic and national interests affected by the gradual retrocession of the Turkish Empire in Europe, and the problem of disposing of the territory thus left, or presumably to be left. Bulgaria, Roumania, Servia, and Greece are the new states which have naturally arisen on the withdrawal of the Turkish power, and their history in connection with the respective policies of England, France, Austria, and Russia toward them is the history of the phases of the "Eastern Question" so far. The Crimean war of 1854–56 with the Treaty of Paris which followed, the Russo-Turkish war of 1877–78 with the Treaty of Berlin, and the Greco-Turkish war of 1897, are among the notable events connected with this subject.

EASTERN ROUMELIA, a portion of the Turkish dominions in Europe lying on the south of Bulgaria from which it is separated by the Balkan Mountains; area, 13,500 sq. miles. The country is fertile, but agriculture is backward; wheat, wine, tobacco, etc., are produced; timber is abundant. The chief town is Philippopolis. East Roumelia was constituted an autonomous province of Turkey by the Treaty of Berlin in 1878, but has since attached itself to Bulgaria. (See Bulgaria.) Pop. 975,000.

EAST INDIA COMPANY, a great English company, originally simply a trading association, which played an important part in the history of Hindustan. It was formed in 1599 in London, with a subscribed capital of about $150,000, for the purpose of trade with the East Indies. A charter was granted to it by Queen Elizabeth on 31st December, 1600, for fifteen years, renewable for a similar period. In this charter the company is styled, "The Governor and Company of the Merchants of London trading into the East Indies." In 1617–18 the company was so enlarged as to include 954 proprietors, while a new joint-stock of $8,000,000 was subscribed. A new charter, granted by Charles II. in 1660, enlarged the powers of the company, giving it political and judicial authority in the factories and colonies established by it, with the right to appoint governors. On the revolution of 1688 the company was involved in new difficulties, and in 1692 the commons presented an address to the crown praying for their dissolution. A resolution in favor of the formation of a new company passed the House of Commons on 4th May, 1698, and this company was actually constituted by Act 9, William III. This act provided for the extinction of the old company, but an amalgamation was eventually arranged in 1708. The renewal of the company's charter in 1834 took place amid continued opposition to their mercantile, and even to their legislative privileges. It continued them in all their possessions except the island of St. Helena, put an end to the exclusive right of trade with China, and enacted that the company should with all convenient speed close their commercial business, and make sale of all their property not retained for government purposes; all their other property was to be held in trust for the crown, which was to take over their debts and guarantee their dividend out of the revenues of India. Henceforth the company existed only for the purpose of receiving payment of its capital, and of the dividends due upon capital until its repayment.

EAST INDIES, the name loosely applied to Hindustan, the Indo-Chinese peninsula, and a portion of the Eastern Archipelago, but excluding the Philippine Islands, New Guinea, and Australia.

EASTLAKE, Sir Charles Lock, English painter, president of the Royal Academy, born at Plymouth 17th November, 1793. He studied at the Royal Academy, London, and at Paris. In 1830 he was elected member of the Royal Academy, and in 1850 became its president, receiving at the same time the honor of knighthood. He died at Pisa 23d December, 1865.

EAST LIVERPOOL, a city in Columbiana co., Ohio, on the Ohio river; 44 miles w.n.w. of Pittsburg and 44 miles e. of Wheeling; has excellent educational advantages; is one of the most important pottery-ware manufacturing centers in the U. States, having thirty potteries. Pop. 69,285.

EASTON, a city and railway center, the capital of Northampton co., Pa., situated at the confluence of the Delaware and Lehigh rivers; 75 miles from New York and 60 miles fom Philadelphia. The famous treaty with the Five Nations is recorded as having taken place at the forks of the Delaware. Pop. 29,848.

EAST ORANGE, a town in Essex co., N. J., situated on the D., L. and W. railroad and the Wachung branch of the N. Y. and Greenwood Lake railway; 12 miles from New York and adjoining Newark on the west. It is a place of suburban residences for New York business men. Pop. 25,170.

EAST RIVER, a strait in New York state, separating New York from Brooklyn and connecting Long Island Sound with New York Bay, about 20 miles long. A great supension-bridge crosses between New York and Brooklyn.

EAST SAGINAW, the eastern portion of Saginaw city, Michigan, on the navigable river Saginaw, about 17 miles from its mouth in Saginaw Bay (Lake Huron). It has a large trade and important manufactures. See Saginaw.

EAST SAINT LOUIS, a city of Illinois, in St. Clair county, opposite Saint Louis, Mo. It is an important manufacturing and railroad center and contains many large buildings and several miles of paved streets. It has a population of 30,000.

EAU (ō), a French word signifying water, and used in English with some other words for several spirituous waters, particularly perfumes, as eau de Cologne, eau de Luce, etc.—Eau de Cologne is a fragrant water, made originally and in most perfection in Cologne. It consists of spirits of wine flavored by different essential oils blended so as to yield a fine fragrant scent.—Eau Créole, a highly-esteemed liqueur made in Martinique by distilling the flowers of the mammee apple with spirit of wine.—Eau de Luce ("water of Luce"), is made by dissolving white soap in spirit of wine, and adding oil of amber and sal ammoniac. It is a milky fluid, antispasmodic and stimulant.—Eau de Vie ("water of life"), a term used by the French for the coarser kinds of brandy, cognac being the name of the best.

EAU CLAIRE (ō klār), the county seat of Eau Claire county, Wis., 85 miles from Saint Paul, Minn. It has considerable manufacturing interests. Pop. 21,517.

EBERS (ā'bėrz), Georg Moritz, German Egyptologist and novelist, born 1st March 1837 at Berlin. His most important works have been translated into English, such as Egypt, Descriptive, Historical, and Picturesque, and the novels, An Egyptian Princess, Uarda, Homo Sum, The Emperor, The Sisters, all dealing with old Egyptian life; The Burgomaster's Wife, Only a Word, etc. He died in 1898

EB'ONY, the popular name of various plants of different genera, agreeing in having wood of a dark color. The most

Ebony.

valuable is the heart-wood, which grows in great abundance in the flat parts of Ceylon, and is of such size that logs of its heart-wood 2 feet in diameter and from 10 to 15 feet long are easily pro-

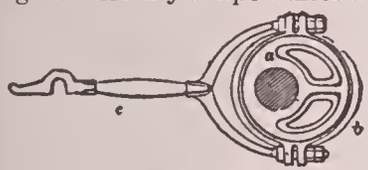
cured. Ebony is hard, heavy, and durable, and admits of a fine polish or gloss. The most usual color is black, red, or green. The best is jet black, free from veins, very heavy, astringent, and of an acrid pungent taste. On burning coals it yields an agreeable perfume, and when green it readily takes fire from its abundance of fat. It is wrought into toys, and used for mosaic and inlaid work.

EBULLITION, the boiling of a fluid. See Boil.

ECARTE (ā-kär'tā), a game at cards for two persons played with thirty-two cards, the small cards from two to six being excluded. In the English mode of playing the game the players cut for the deal, which is decided by the lowest card. The dealer gives five cards to either player, three and two at a time, and turns up the eleventh card for trump. If he turns up a king he scores one, and if a king occurs in the hand of either player he may score one by announcing it before the first trick. The cards rank as follows: king (highest), queen, knave, ace, ten, etc. The non-dealer leads; trumps take all other suits, but the players must follow suit if they can. Three tricks count one point, five tricks two points; five points make game. Before play begins the non-dealer may claim to discard (écarter) any of the cards in his hand, and have them replaced with fresh ones from the pack. This claim the dealer may or may not allow. Should he allow he can discard as many as he pleases. Sometimes only one discard is allowed, sometimes more.

ECCE HOMO (ek'sē-), a name often given to crucifixes and pictures which represent Christ bound and crowned with thorns.

ECCEN'TRIC, a term in mechanics applied to contrivances for converting circular into reciprocating (backward and forward) rectilinear motion, consisting of variously-shaped discs attach-



Eccentric of steam-engine—*a*, Eccentric wheel; *b*, Eccentric-strap; *c*, Eccentric-rod.

ed to a revolving shaft not in their center. An eccentric wheel is a wheel fixed on an axis that does not pass through the center. Its action is that of a crank of the same length as the eccentricity.

ECCLESIAS'TES (-tēz), the title by which the Septuagint translators rendered the Hebrew Coheleth ("the gatherer of the people"), a symbolic name explained by the design of the book and the dramatic position occupied by Solomon in it, one of the canonical books of the Old Testament. According to Jewish tradition it was written by Solomon; but the best modern criticism has decided that its style and language, no less than its thought, belong to a much later date.

ECHIDNA (ē-kid'na), a genus of Australian monotrematous, toothless mammals, in size and general appearance resembling a large hedgehog, excepting that the spines are longer, and the muzzle is protracted and slender, with a small aperture at the extremity for the protraction of a long flexible tongue. The habits of the Echidna are nocturnal; it burrows, having short strong legs with five toes, and feeds on insects,

Porcupine ant eater.

which it catches by protruding its long sticky tongue. It is nearly allied to the Ornithorhynchus, the two forming a peculiar class of animals, having in their structure some peculiarities at once of mammals, birds, and reptiles. In 1884 it was found, that, as Geoffroy St. Hilaire had suspected, the echidna and ornithorhynchus, although essentially mammals, were yet oviparous, producing their young from eggs. One species from its appearance, is popularly known as the porcupine ant-eater.

ECHO (ek'ō), the repetition of a sound caused by the reflection of sound-waves at some moderately even surface, as the wall of a building. The waves of sound on meeting the surface are turned back in their course according to the same laws that hold for reflection of light. In order that the echo may return to the place from which the sound proceeds the reflection must be direct, and not at an angle to the line of transmission, otherwise the echo may be heard by others but not by the transmitter of the sound. This may be effected either by a reflecting surface at right angles to the line of transmission, or by several reflecting surfaces which end in bringing the sound back to the point of issue. Sound travels about 1125 feet in a second; consequently, an observer standing at half that distance from the reflecting object would hear the echo a second later than the sound. Such an echo would repeat as many words and syllables as could be heard in a second. As the distance decreases the echo repeats fewer syllables till it becomes monosyllabic. The most practiced ear cannot distinguish in a second more than from nine to twelve successive sounds, so that a distance of not less than 60 feet is needed to enable a common ear to distinguish between the echo and the original sounds. At a near distance the echo only clouds the original sounds, and this often interferes with the hearing in churches and other large buildings. Woods, rocks, and mountains produce natural echoes in every variety, for which particular localities have become famous.—In Greek mythol. Echo was a nymph (one of the Oreads) who fell in love with Narcissus, and because he did not reciprocate her affection she pined away until nothing was left but her voice.

ECKELS, James Herron, an American financier, born in Princeton, Ill., 1858. He was comptroller of the currency from 1893 to 1898, since which time he has been president of the Commercial National Bank of Chicago.

ECKFORD, Henry, an American ship designer, born in Scotland in 1775, died in 1832. In 1796 he removed to the United States, established a ship yard, and built the Robert Fulton, the first successful ocean-going steamship.

ECLEC'TICS is a name given to all those philosophers who do not follow one system entirely, but select what they think the best parts of all systems. In this century the eclectic method found a notable supporter in the French philosopher Victor Cousin.

ECLECTIC SCHOOL OF MEDICINE, a school of medicine, founded in the United States in 1826 and represented today by 22 colleges and a considerable number of practitioners. The eclectic school teaches that the best practice of medicine is found in choosing remedies regardless of the "isms" of the discoverers.

ECLIPSE (ek-lips'), an interception or obscuration of the light of the sun, moon or other heavenly body by the intervention of another and nonluminous heavenly body. Stars and planets may suffer eclipse, but the principal eclipses are those of the sun and the moon.

An eclipse of the moon is an obscuration of the light of the moon occasioned by an interposition of the earth between the sun and the moon; consequently, all eclipses of the moon happen at full moon; for it is only when the moon is on that side of the earth which is turned away from the sun, and directly opposite, that it can come within the earth's shadow. Further, the moon must at

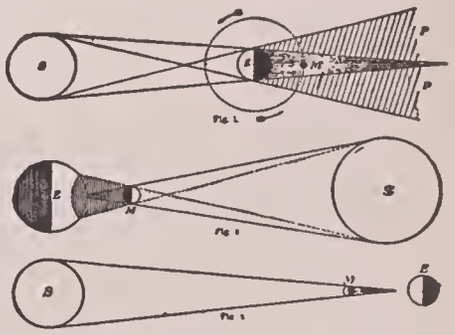


Diagram illustrating the theory of eclipses.

that time be in the same plane as the earth's shadow; that is, the plane of the ecliptic in which the latter always moves. But as the moon's orbit makes an angle of more than 5° with the plane of the ecliptic, it frequently happens that though the moon is in opposition it does not come within the shadow of the earth. The theory of lunar eclipses will be understood from Fig. 1, where s represents the sun, e the earth, and m the moon. If the sun were a point of light there would be a sharp outlined shadow or umbra only, but since the luminous surface is so large there is always a region in which the light of the sun is only partially cut off by the earth, which region is known as the penumbra (p p). Hence during a lunar eclipse the moon first enters the penumbra, then is

totally eclipsed by the umbra, then emerges through the penumbra again.

An eclipse of the sun is an occultation of the whole or part of the face of the sun occasioned by an interposition of the moon between the earth and the sun; thus all eclipses of the sun happen at the time of new moon. Fig. 2 is a diagram showing the principle of a solar eclipse. The dark or central part of the moon's shadow, where the sun's rays are wholly intercepted, is here the umbra, and the light part, where only a part of them are intercepted, is the penumbra; and it is evident that if a spectator be situated on that part of the earth where the umbra falls there will be a total eclipse of the sun at that place; in the penumbra there will be a partial eclipse, and beyond the penumbra there will be no eclipse. As the earth is not always at the same distance from the moon, and as the moon is a comparatively small body, if an eclipse should happen when the earth is so far from the moon that the moon's shadow falls short of the earth, a spectator situated on the earth in a direct line between the centers of the sun and moon, would see a ring of light round the dark body of the moon; such an eclipse is called annular, as shown in Fig. 3; when this happens there can be no total eclipse anywhere, because the moon's umbra does not reach the earth. An eclipse can never be annular longer than 12 minutes 24 seconds, nor total longer than 7 minutes 58 seconds; nor can the entire duration of an eclipse of the sun ever exceed 2 hours.

An eclipse of the sun begins on the western side of his disc and ends on the eastern; and an eclipse of the moon begins on the eastern side of her disc and ends on the western. The average number of eclipses in a year is four, two of the sun and two of the moon; and as the sun and moon are as long below the horizon of any particular place as they are above it, the average number of visible eclipses in a year is two, one of the sun and one of the moon.

ECLIP'TIC, the sun's path, the great circle of the celestial sphere, in which the sun appears to describe his annual course from west to east—really corresponding to the path which the earth describes. (See Earth.) The Greeks observed that eclipses of the sun and moon took place near this circle; whence they called it the ecliptic. The ecliptic has been divided tnto twelve equal parts, each of which contains 30 degrees, and which are occupied by the twelve celestial signs or constellations, viz.·

♈ = Aries (the Ram), March 20.
♉ = Taurus (the Bull), April 20.
♊ = Gemini (the Twins), May 21.
♋ = Cancer (the Crab), June 21.
♌ = Leo (the Lion), July 22.
♍ = Virgo (the Virgin), August 23.
♎ = Libra (the Balance), September 23.
♏ = Scorpio (the Scorpion), October 23.
♐ = Sagittarius (the Archer), Nov. 22.
♑ = Capricornus (the Goat), Dec. 21.
♒ = Aquarius (the Water-carrier), Jan. 19.
♓ = Pisces (the Fishes), February 18.

These are also called signs of the zodiac, the zodiac being a belt of the heavens extending 9 degrees on each side of the ecliptic. The days of the month annexed show when the sun, in its annual revolution, enters each of the signs of the zodiac. From the first point of Aries, or the place of the sun at the vernal equinox, the degrees of the ecliptic are counted from west to east. The plane of the ecliptic is that by which the position of the planets and the latitude and longitude of the stars are reckoned. The points at which the equator and ecliptic intersect are subject to a continual variation, receding westward at the rate of about 50 seconds a year. The angle at which the ecliptic stands to the equator is also variable, and has been diminishing for about 4000 years at the rate of about 50 seconds in a century. Laplace showed, however, that this variation has certain fixed limits, and that after a certain time the angle will begin to increase again. The combined result of these two changes is to cause the pole of the earth not to point constantly to the same spot in the heavens, but to describe an undulating circle round a certain point; but this movement is so slow that it takes many thousand years to complete it. See Nutation and Precession.

ECLOGUE (ek'log), a term usually applied to what Theocritus called idyls —short, highly-finished poems, principally of a descriptive or pastoral kind.

ECOLE POLYTECHNIQUE, a school in Paris established with the purpose of giving instruction in matters connected with the various branches of the public service, such as mines, roads and bridges, engineering, the army and the navy, government manufactures, etc. It was founded in 1794, and is under the direction of the minister of war. Candidates are admitted only by competitive examination, and have to pay for their board 1000 francs (about $200) a year. The pupils who pass satisfactory examinations at the end of their course are admitted to that branch of public service which they select.

ECUADOR (ek-wâ-dōr'), a republic of S. America, situated under the equator, whence it takes its name, between Peru and Colombia. Area, about 248,386 sq. miles, or including the Galapagos Islands, 251,337 sq. miles. The mountain region is formed by a double range of snow-clad mountains—several of them active volcanoes—which inclose a longitudinal valley or table-land, with a breadth of 20 to 40 miles, and varying in elevation from 8500 to 13,900 feet. The most elevated of these mountains are, in the western range, Chimborazo, Pichincha, and Cotacachi, Chimborazo being 20,703 feet high. The chief towns here are Quito, the capital, with a pop. of 80,000; Riobamba, and Cuenca, all situated at a height of 9000 feet or more above the sea. The chief ports of Ecuador are Guayaquil and Esmeraldas. The most considerable rivers, the Tigre, Napo, Pastaza, etc., belong to the basin of the Amazon. Ecuador is comparatively poor in mammalia; although various kinds of deer as well as tapirs and peccaries are found in the forests. Parrots and humming-birds are also numerous, but perhaps the most remarkable of the birds in Ecuador is the condor, which dwells on the slopes of the Andes. Reptiles, including serpents, are numerous. The forests yield cinchona bark, caoutchouc, sarsaparilla, vegetable ivory, etc. The climate on the plains, both in the east and the west, is moist, hot, and unhealthy. In the higher regions the climate is rough and cold, but in great part the elevated valleys, as that of Quito, enjoy a delightful climate. Here the chief productions are potatoes, barley, wheat, and European fruits. In the lower regions are grown all the food-products of tropical climates, cacao, coffee, sugar, etc. Cacao forms three-fourths (or more) of the whole export; the remainder is made up of coffee, hides, vegetable ivory, caoutchouc, etc. The people are poorly educated. The religion is exclusively Roman Catholic. The executive government is vested in a president elected for four years, who is assisted by a council of state. The congress is the legislative body, and consists of two houses, one formed of senators, two for each province, the other of deputies, one for every 30,000 inhabitants, both elected by universal suffrage. The money unit is the sucre, equivalent to a 5-franc piece, but the coins of the U. States, France, and Britain circulate. Railways and telegraphs have made little progress.—Ecuador at the time of the conquest of Peru by the Spaniards formed part of the great empire of the Incas. Of the present population, the aboriginal red race form more than half; the rest are negroes, mulattoes, mestizos, a degenerate breed of mixed negro and Indian blood, and Spanish Creoles or whites. The latter are the chief possessors of the land, but are deficient in energy. Pop. estimated, 1,275,000.

ECUMENICAL COUNCIL, a general ecclesiastical council regarded as representing the whole Roman Catholic Church. The last was held at Rome in 1870. There were present 803, including cardinals, archbishops, bishops, abbots, and generals of orders. After much discussion, and the withdrawal of a numher of bishops, the infallibility of the pope as head of the church was affirmed and promulgated.

EC'ZEMA, a disease of the skin, marked by an eruption of small vesicles, preceded by redness, heat, and itching of the part. In course of time the minute vesicles burst, and discharge a thin acrid fluid, which often gives rise to excoriation. The most severe form of this disease arises from constitutional conditions, but purely local attacks are likewise caused by exposure of the skin to irritating substances.

EDDA, the name given to two ancient Icelandic works, the one consisting of mythological poems, the other being mainly in prose. The first of these collections, called the Older or Poetic Edda, was compiled in the 13th century. For a long time an earlier date was given, the compiler being erroneously believed to have been Sæmund Sigfusson, a learned Icelandic clergyman, who lived from about 1056 to 1133. It consists of thirty-three pieces, written in alliterative verse, and comprising epic tales of the Scandinavian gods and goddesses, and narratives dealing with the Scandinavian heroes. These poems are now

assigned to a period extending from the 9th to the 11th century. The prose Edda, or Younger Edda, presents a kind of prose synopsis of the Northern mythology; a treatise on the Scaldic poetry and versification, with rules and examples; and lastly a poem (with a commentary) in honor of Haco of Norway (died 1263). In its earliest form this collection is ascribed to Snorri Sturluson, who was born in Iceland in 1178, and was assassinated there in 1241 on his return from Norway, where he had been scald or court poet.

EDDY, Clarence, an American organist, born in Massachusetts in 1851. In 1894 he became organist of the First Congregational Church in Chicago. He has composed a considerable quantity of organ music and has translated important text-books from the German.

EDDY, Mary Baker Glover, the founder of Christian Science, born in New Hampshire in 1822. She discovered Christian Science in 1866, founded the first Christian Science Church in 1879 at Boston, and the Massachusetts Metaphysical College in 1881. Her principal work is Science and Health, with Key to the Scriptures, in which the doctrines of Christian Science are set forth. (See Christian Science.)

EDDYSTONE LIGHTHOUSE, a lighthouse in the English Channel, erected to mark a group of rocks lying in the fair way from the Start to the Lizard. The rocks are covered only at the flood.

EDELWEISS (ā'dėl-vīs), a composite plant inhabiting the Alps, and often growing in the most inaccessible places. Its flower-heads are surrounded by a

Edelweiss.

spreading foliaceous wooly involucre, and its foliage is also of the same woolly character. It is not difficult to cultivate, but is apt to lose its peculiar woolly appearance.

E'DEN, the original residence of the first human pair. It is said to have had a garden in the eastern part of it, and we are told that a river went out of Eden to water this garden, and from thence it was parted into four heads, which were called respectively Pison, Gihon, Hiddekel, and Euphrates (Phrat), but this does not enable us to identify the locality. It was not the whole of Eden that was assigned to man for his first habitation, but the part toward the east, to which the translators of the Authorized Version have given the name of the Garden of Eden, and which Milton, in Paradise Lost, calls Paradise, that word (originally Persian) having in its Greek form (paradeisos) been applied to the Garden of Eden by the translators of the Septuagint.

EDENTA'TA (ē-), or toothless animals, the name of an order of Mammalia, though only two genera of the order want teeth, the ant-eaters, and the pangolins. The remainder are merely

1, Skull and (3) tooth of a small species of armadillo. 2, Skull of Great ant-eater.

destitute of teeth in the front of the jaws. The teeth they possess, however, are destitute of enamel, do not have complete roots, and are not replaced by a second set. This order is also characterized by the presence of great claws surrounding the ends of the toes, and more or less approximating to the nature of hoofs. It is divided into two sections, the first comprehending the sloths, which subsist on vegetable food, and the gigantic fossil animals the Megatherium and the Megalonyx; and the second including the armadillos and the ant-eaters, which live mainly on insects, though some of the armadillos eat other sorts of animal food, and also vegetables.

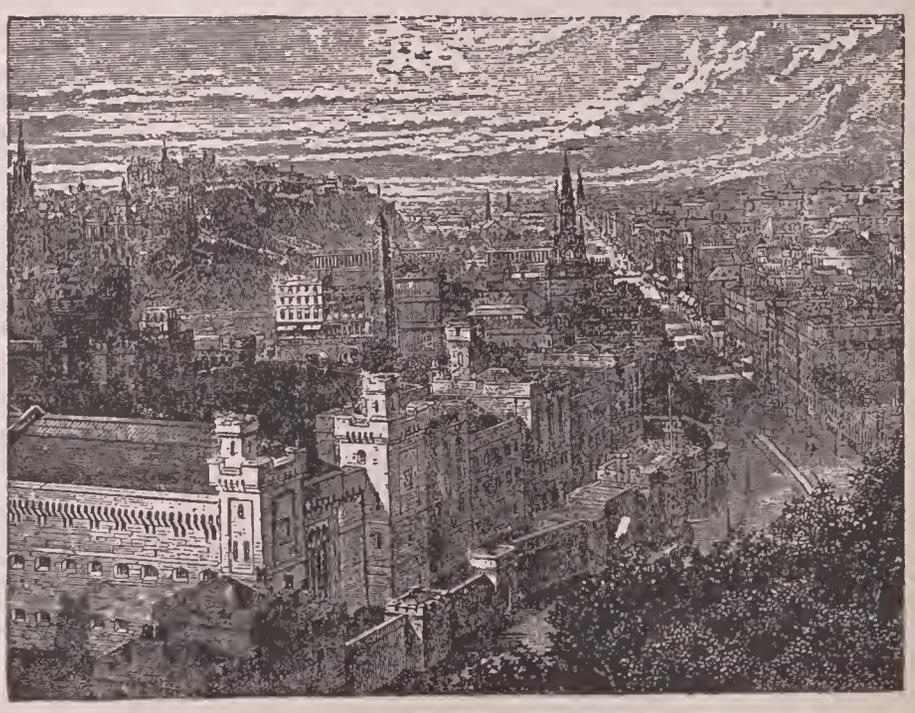
EDGAR ATHELING, grandson of Edmund Ironside and son of Edward the Outlaw, was born in Hungary, where his father had been conveyed in infancy to escape the designs of Canute. After the battle of Hastings, Edgar (who had been brought to England in 1057) was proclaimed king of England by the Saxons, but made peace with William and accepted the Earldom of Oxford.

EDIBLE BIRDS' NESTS. See Birds'-nests, Edible.

EDICT, a public proclamation by a sovereign, a governor, or other competent official.

EDICT OF NANTES. See Nantes.

ED'INBURGH, the metropolis of Scotland, and one of the finest as well as most ancient cities in the British empire, lies within 2 miles of the south shore of the Firth of Forth. It is picturesquely situated, being built on three eminences which run in a direction from east to west, and surrounded on all sides by lofty hills except on the north, where the ground slopes gently toward the Firth of Forth. The central ridge, which constituted the site of the ancient city, is terminated by the castle on the west, situated on a high rock, and by Holyrood House on the east, not far from which rise the lofty elevations of Salisbury Crags, Arthur's Seat (822 feet high), and the Calton Hill overlooking the city. Among the notable buildings are the ancient Parliament House, now the seat of the supreme courts of Scotland; St. Giles's Church or Cathedral, an imposing edifice in the later Gothic style, recently carefully restored; the Tron Church; Victoria Hall (where the General Assembly of the Established Church meets), with a fine spire; the Bank of Scotland; etc., besides some of the old family houses of the Scottish nobility and other buildings of antiquarian interest. In the old town the most remarkable public building is the castle. This fortress contains accommodation for 2000 soldiers, and the armory space for 30,000 stand of arms. In an apartment here are kept the ancient regalia of Scotland. The palace of Holyrood, or Holyrood House, as it is more generally called, stands at the lower or eastern extremity of the street leading to the castle. In the northwest angle of the building are



Edinburgh, showing the prison, the castle, Scott monument, Princess street, etc.

the apartments which were occupied by Queen Mary, nearly in the same state in which they were left by that unfortunate princess. Adjoining the palace are the ruins of the chapel belonging to the Abbey of Holyrood, founded in 1128 by David I. On the south side of the Old Town, and separated from it also by a hollow crossed by two bridges (the South Bridge and George IV. Bridge), stands the remaining portion of the city, which, with the exception of a few unimportant streets, is mostly modern. Besides the buildings already noticed Edinburgh possesses a large number of important edifices and institutions, chief among which are the Royal Institution (accommodating the Royal Society and other bodies), the National (Picture) Gallery, the National Portrait Gallery, the Museum of Science and Art, the Episcopal Cathedral of St. Mary's, the High-school register office, etc. Among the more prominent educational institutions are the University, the High-school, the Academy, the Free Church Theological College, the United Presbyterian Theological Hall, the Edinburgh School of Medicine, the Veterinary College, the Fettes College, on the model of the great English public schools, the Heriot-Watt College, technical, commercial, and literary, several endowed secondary schools. The Advocates' Library, the largest in Scotland, contains upward of 300,000 printed volumes and 3000 MSS.; the University Library, 200,000; the Library of Writers to the Signet, 90,000. There is also a rate-supported public library. The town was made a royal burgh in the time of David I.; but it was not till the 15th century that it became the recognized capital of Scotland. Pop. 316,479.—The county of Edinburgh or Midlothian is bounded n. by the Firth of Forth, along which it extends 11 or 12 miles; and by the counties of Linlithgow, Haddington, Berwick, Lanark, Peebles, Selkirk, and Roxburgh; area, 234,926 acres, over half of which is arable or under permanent pasture. The principal rivers are the North and South Esks and the Water of Leith, all running into the Forth. The chief crops are oats, barley, turnips, and potatoes. The manufactures are comparatively limited, but include ale, whisky, gunpowder, paper, tiles, etc. The fisheries are valuable. The chief towns are: Edinburgh, Leith, Dalkeith, Musselburgh, and Portobello. Pop. 488,647.

EDINBURGH, Duke of, H.R.H., Prince Alfred Ernest Albert, K.G., K.T., K.P., etc., late Duke of Saxe-Coburg-Gotha, the second son of Queen Victoria, was born at Windsor Castle, Aug. 6, 1844. In 1862 he declined the offer of the throne of Greece. In 1874 he married the Grand-duchess Marie, only daughter of the Emperor of Russia. In 1893 he succeeded his uncle as ruler of Saxe-Coburg-Gotha, He had one son (who predeceased him) and four daughters. He died in 1900.

EDINBURGH UNIVERSITY, the latest of the Scottish universities, was founded in 1582 by a charter granted by James VI. The number of chairs is now over forty, besides assistants. The university is a corporation consisting of a chancellor, rector, principal, professors, registered graduates and alumni, and matriculated students. Its government is administered by the University Court, the Senatus Academicus, and the General Council, as in the other Scottish universities, in all of which new ordinances have been introduced under the Universities (Scotland) Act of 1889. The University Court, which is the supreme governing body of the university, consists of the rector, who is president, the principal, the Lord-provost of Edinburgh, and eleven assessors. The Senatus superintends the teaching and discipline of the university, and consists of the principal and professors. The General Council consists of the chancellor, who is president, the members of the University Court and Senatus, and the graduates of the university. It takes cognizance of matters generally affecting the well-being of the university. The chancellor is the official head of the university, and it is through him or his deputy, the vice-chancellor, that degrees are conferred. He is elected for life by the general council. The principal is the resident head of the university and president of the Senatus, and is appointed for life (at Edinburgh by a body called the "Curators," elsewhere by the crown). The rector is elected for three years by the matriculated students. There are six faculties in the university, viz. arts, science, divinity, law, medicine, and music. The library contains 200,000 volumes. There are bursaries, scholarships, and fellowships, amounting annually to about $60,000.

EDISON, Thomas Alva, a noted American inventor, born in Ohio in 1847. He began his career as a newsboy on the Grand Trunk Railway, and early began to experiment with mechanical and electrical devices. He learned the art of telegraphy at Mount Clemens, Mich., and soon afterward invented his automatic repeater. Going to Boston he secured work as an operator and was meanwhile busy with new inventions, among them a vote recorder, and the so-called "ticker" for the printing of market quotations. His greatest invention was that of the quadruplex telegraph system which revolutionized the art of telegraphy. He improved the telephone, invented the phonograph, and perfected the incandescent electric light. Edison has taken out hundreds of patents many of which have proved to be failures. He may be truly said, however, to be the greatest inventor of history.

ED'MONTON, a town in England, county of Middlesex, 7½ miles north of London, with an extensive trade in timber, carried on by the Lea River navigation. The "Bell at Edmonton" has become famous by association with the adventures of Cowper's John Gilpin. Pop. 46,899.

EDMUND I., King of England, an able and spirited prince, succeeded his brother Athelstan in 940. He conquered Cumbria, which he bestowed on Malcolm, king of Scotland, on condition of doing homage for it to himself. He was slain at a banquet May 26, 946.

EDMUND II., surnamed Ironside, King of England, was the eldest son of Ethelred II., and was born in 989. He was chosen king in 1016, Canute having been already elected king by another party. He won several victories over Canute, but was defeated at Assandun in Essex, and forced to surrender the midland and northern counties to Canute. He died after a reign of only seven months.

EDRIOPHTHAL'MATA, one of the great divisions of the Crustacea, including all those genera which have their eyes sessile, or imbedded in the head,

Edriophthalmata.

1, Fresh-water shrimp. *a*, single eye. 2, Head of cymothoa. *b*, clusters of simple eyes.

and not fixed on a peduncle or stalk as in the crabs, lobsters, etc. It includes slaters, sandhoppers, woodlice, etc. Some are parasitic on fishes, and of the others some live in the sea and some on land, as the common and the sea woodlouse.

EDSON, Cyrus, an American physician born in New York in 1857. He has been active in the sanitation affairs of New York City and is the inventor of several important surgical instruments.

EDUCATION, in the widest sense, all that course of instruction and discipline which is intended to enlighten the understanding, correct the temper, cultivate the taste, and form the manners and habits of youth, and fit them for usefulness in their future stations. Or it may be defined as the art or scientifically-matured system of developing and cultivating the various physical, intellectual, æsthetic, and moral faculties; and may thence be divided into four branches—physical, intellectual, æsthetic, and moral education. Under physical education is included all that relates to the healthy development of the organs of sensation and the muscular and nervous system. Intellectual education comprehends the means by which the powers of the understanding are to be developed and improved, and the imparting of instruction in the various branches of knowledge. Æsthetic education comprehends the agencies which purify and refine the mind by training it to perceive and take delight in what is beautiful, true, and pure in nature, literature, and art. Moral education (in which may or may not be included religious education) embraces the various methods of cultivating and regulating the affections of the heart. In the popular view education is much the same as instruction, and is regarded as consisting simply in the lessons and discipline learned in connection with attendance at school. So far as governments or other public bodies have interested themselves in the education of youth this view is tolerably correct; but probably the most perfect system of education would be one in which schools formed no part whatever. Schools, however, seem to have been

established at a very early period in the history of all civilized communities, though not necessarily in connection with any system of national education. Indeed a thoroughly-organized system of national education exists in but few states, Germany being the most conspicuous example of such. In England no national system existed till the passing of the education act of 1870, and in Britain it is only elementary education that can be said to be established on a satisfactory footing. A complete system of national education ought to make satisfactory provision for primary or elementary education, secondary education, and higher or university education, besides providing for the due education of teachers, and for technical education, commercial education, artistic education, etc.; but how far education in any department should be free (or at the expense of the state) is a question on which authorities are not agreed. Elementary education is practically free in Britain, France, Italy, Germany, the United States, Canada. several of the Australian colonies, and elsewhere. In a properly-organized system the three great classes of educational institutions would be interdependent, the primary schools supplying pupils satisfactorily equipped for passing into the secondary schools, and these again passing on a certain number of their pupils to the university sufficiently equipped for entering on their more advanced studies. It is generally agreed that elementary education should be compulsory, and this is now the law in Britain, Germany, France, Italy, Denmark, many of the United States, etc.; but the law may exist with more or less laxity in the enforcement of it. The elementary schools have, at their special province, the teaching of those branches of education that everyone ought to be instructed in, such as reading, writing, arithmetic, grammar, geography, etc.; but they usually teach also a number of other subjects. The secondary schools include institutions known as high schools, academies, grammar-schools, colleges, etc. The subjects taught in them are such as ancient and modern languages, mathematics, science, history, geography, etc., and they may either prepare pupils who intend to engage in commerce or other business, or who intend to proceed to the university. Thus in some secondary schools there is a modern side and a classical side (or similar divisions); while in Germany there are the two distinct classes of schools, the "real-schools,") for modern subjects), and the gymnasia. The universities provide an education for the so-called "learned profession," as well as for all who appreciate the advantages of a university training. Their most characteristic feature is the privilege of granting degrees. Since 1900, English education, primary, secondary, and technical, has been under the control of the board of education, consisting of a president, the lord-president of the council, the principal secretaries of state, the first commissioner of the treasury, and the chancellor of the exchequer. There are separate education departments for Scotland and Ireland.

EDUCATION, COMMERCIAL, in the United States the teaching of account keeping, and other arts used in the conduct of business generally. Commercial education differs from technical education in that the American business or commercial college does not include the sciences in its curriculum. Of recent years institutions of higher education have taken up technical and commercial education on a scale much larger than before, and the importance of this branch of learning is a constantly growing quantity in American educational systems. The number of students in independent business colleges agregates hundreds of thousands.

EDUCATION, COMMISSIONER OF, the title of the chief of the United States Bureau of Education at Washington, D.C. He is appointed by the president and has charge of all educational statistics.

EDUCATIONAL ASSOCIATION, the National, an association of American teachers, organized in 1857 and incorporated in 1886. Annual meetings of the association are held in various parts of the country and the members read papers upon and discuss all aspects of their profession. The annual reports of the society are the most important educational documents published in the United States.

EDWARD, known as the Elder, King of England, son of Alfred the Great, born about 870, succeeded his father in 901. His reign was distinguished by successes over the Danes. He died in 925.

EDWARD, surnamed the Martyr, King of England, succeeded his father, Edgar, at the age of fifteen, in 975. He was treacherously slain in 979 by a servant of his step-mother, at her residence, Corfe Castle. The pity caused by his innocence and misfortune induced the people to regard him as a martyr.

EDWARD, King of England, surnamed the Confessor. On the death of his maternal brother, Hardicanute the Dane, in 1041, he was called to the throne, and thus renewed the Saxon line. His queen was the daughter of Godwin, earl of Kent. He died in 1066, and was succeeded by Harold, the son of Godwin. He caused a body of laws to be compiled from those of Ethelbert, Ina, and Alfred, to which the nation was long fondly attached. He was canonized by Pope Alexander III. in 1166.

EDWARD, Prince of Wales, surnamed the Black Prince, born June 15, 1330, the eldest son of Edward III. and Philippa of Hainault. In 1346 he commanded part of the forces at the battle of Crécy, and earned the praise of his warlike father. It was on this occasion hat he adopted the motto Ich dien (I serve), used by all succeeding princes of Wales. He died in 1376.

EDWARD I. (of the Norman line), King of England, son of Henry III., was born at Winchester in 1239. The contests between his father and the barons called him early into active life, and he finally quelled all resistance to the royal authority by the decisive defeat of Leicester at the battle of Evesham, in 1265. During his reign great progess was made in the establishment of law and order throughout the land. He died in 1307.

EDWARD II., King of England, born at Caernarvon Castle in 1284, and the first English Prince of Wales, succeeded his father, Edward I., in 1307. The king's fondness for a favorite, Hugh le Despenser, had made a number of malcontents, and Queen Isabella, making a visit to France, entered into a correspondence with the exiles there, and formed an association of all hostile to the king. Aided with a force from the Count of Hainault she landed in Suffolk in 1326. Her army was completely successful. The Despensers were captured and executed, and the king was taken prisoner and confined in Kenilworth, and ultimately in Berkeley Castle, where he was murdered 21st Sept. 1327.

EDWARD III., King of England, son of Edward II. by Isabella of France, was born in 1313. On his father's deposition in 1327 he was proclaimed king under a council of regency. Collecting an army and accompanied by the Black Prince, he crossed over to France. The memorable battle of Crécy followed, August 25, 1346, which was succeeded by the siege of Calais. In the meantime David II., having recovered the throne of Scotland invaded England with a large army, but was defeated and taken prisoner by a much inferior force under Lord Percy. In 1348 a truce was concluded with France; but on the death of King Philip, in 1350, Edward again invaded France, plundering and devastating. Recalled home by a Scottish inroad he retaliated by carrying fire and sword from Berwick to Edinburgh. In the meantime the Black Prince had penetrated from Guienne to the heart of France, fought the famous battle of Poictiers, and taken King John prisoner. A truce was then

Edward the Black Prince—Effigy at Canterbury.

made at the expiration of which (1359) Edward again crossed over to France and laid waste the provinces of Picardy and Champagne, but at length consented to a peace. This confirmed him in the possession of several provinces and districts of France which were intrusted to the Prince of Wales (the Black Prince), but gradually all the English possessions in France, with the exception of Bordeaux, Bayonne, and Calais, were lost. King Edward died a year after his heroic son. June 21, 1377.

EDWARD IV., King of England, was born in 1441. His father, Richard, Duke

of York, was grandson of Edmund, Earl of Cambridge and Duke of York, fourth son of Edward III., while the rival line of Lancaster descended from John of Gaunt, the third son. The victory of Towton, soon after his accession, confirmed his title, and three years after, on May 4, 1464, the battle of Hexham completely overthrew the party of Henry VI. The king now made an imprudent marriage with Elizabeth, widow of Sir John Grey, at the very time when he had despatched the Earl of Warwick to negotiate a marriage for him with the sister of the French king. He thus alienated powerful friends, and Warwick, passing over to the Lancastrian cause, gathered a large army, and compelled Edward to flee the country. Henry's title was once more recognized by parliament. But in 1471 Edward, at the head of a small force given him by the Duke of Burgundy, landed at Ravenspur in Yorkshire, and his army, being quickly increased by partisans, marched swiftly on London and took the unfortunate Henry prisoner. Warwick now advanced with an army to Barnet, where a battle was fought, 4th April, 1471, which ended in the death of Warwick and a decisive victory for Edward. The king was preparing for an expedition against France when he died, in April, 1483.

EDWARD V., King of England, the eldest son of Edward IV., was in his thirteenth year when he succeeded his father in 1483. His uncle, the Duke of Gloucester, soon made himself king as Richard III., and caused the young king and his brother to be sent to the Tower, where, it is said, he had them smothered by ruffians.

EDWARD VI., King of England, son of Henry VIII. by Jane Seymour, was born in 1537. His reign was uneventful. Edward died of a pulmonary complaint in July, 1553.

EDWARD VII., King of Great Britain and Ireland and Emperor of India, eldest son of Queen Victoria and the Prince Consort, was born at Buckingham Palace on Nov. 9, 1841. In December he was created Prince of Wales. He was educated under private tutors and at Edinburgh, Oxford, and Cambridge; visited Canada and the U. States in 1860; and underwent military training at the Curragh camp in 1861. He was promoted to the rank of general in 1862, and in that year visited Palestine and the East. Next year he took his seat in the House of Lords. On March 10, 1863, he was married in St. George's Chapel, Windsor Castle, to Princess Alexandra, eldest daughter of the King of Denmark, and from this time onward he discharged many public ceremonial functions. Attacked by typhoid fever in the winter of 1871, his life was for a time despaired of, but he recovered early in 1872, his recovery being made the occasion of a thanksgiving service in St. Paul's Cathedral. He visited India in 1875–76. He was a member of the poor law commission of 1893. He promoted the establishment of the Imperial Institute as a memorial of Queen Victoria's jubilee (1887), and he commemorated her diamond jubilee (1897) by founding the Prince of Wales's hospital fund for the better financial support of the London hospitals. On the death of Queen Victoria on Jan. 22, 1901, he succeeded to the throne. To him and Queen Alexandra have been born: Albert Victor Christian Edward, Duke of Clarence and Avondale, born 1864, died 1892; George Frederick Ernest Albert, now Prince of Wales and heir-apparent, born 1865, married 1893, to Princess Victoria Mary of Teck; Princess Louise, born 1867, married 1889, to the Duke of Fife; Princess Victoria, born 1868; and Princess Maud, born 1869, married 1896, to a son of the Crown Prince of Denmark.

EDWARDS, Jonathan, a celebrated American theologian and metaphysician, born at East Windsor, Connecticut, October 5, 1703. He entered Yale College in 1716, and studied till 1722, when

Jonathan Edwards

he received a license as preacher. In 1723 he was elected a tutor in Yale College, but resigned in 1726 to be ordained as minister at Northampton, Mass. After more than twenty-three years of zealous service here he was dismissed by the congregation owing to the severity with which he sought to exercise church discipline. He then went as a missionary among the Indians at Stockbridge, in Massachusetts. Here he composed his famous work on the Freedom of the Will, a masterpiece of metaphysical argument. It appeared in 1754, and was completed within four months and a half. In 1757 he was chosen president of the college at Princeton, New Jersey, but died shortly afterward, March 22, 1758.

EDWY, King of England, son of Edmund I., succeeded his uncle Edred in 955. He died in 959, being probably not more than eighteen or nineteen years old.

EEL, the general name of a family of fishes. The eel is characterized by its serpent-like elongated body, by the absence of ventral fins, and the continuity of the dorsal and anal fins round the extremity of the tail. The dorsal fin commences half-way between the head and the anal fin, and the lower jaw projects beyond the upper. The conger eel which is exclusively marine, the dorsal fin commences above the pectoral, and the upper jaw is the longer. The smoothness of the body—the scales being inconspicuous—and the serpentine movements of eels are proverbial.

EFFEN'DI, a Turkish title which signifies lord or master. It is particularly applied to the civil, as aga is to the military officers of the sultan. Thus the sultan's first physician is called Hakim effendi, the priest in the seraglio Iman effendi, etc.

EFFERVES'CENCE, the rapid escape of a gas from a liquid, producing a turbulent motion in it, and causing it to boil up. It is produced by the actual formation of a gas in the liquid, as in fermentation, or by the liberation of a gas which has been forced into it, as in aërated beverages.

EF'FIGY, an image or portrait, most frequently applied to the figures on sepulchral monuments.—To burn or hang in effigy, is to burn or hang an image or picture of a person, a mode in which the populace sometimes expresses its feelings respecting an obnoxious personage.

EFFLORES'CENCE, the fine white, feathery crystallization of sulphate and carbonate of sodium which appears on walls, or similar crystallizations on the surface of the earth, in decomposing rocks, etc. In medicine the term is applied to an eruption or rash, as in measles, etc.

EFFLUVIUM (pl. Effluvia), a noxious or disagreeable exhalation.

EGAN, Patrick, an Irish-American politician, born in Ireland in 1841. Until 1883 he was active in the home rule movement in Ireland, but in that year settled in the U. States at Lincoln, Neb. He was appointed minister to Chile by President Harrison in 1888. Egan for some time was the leader of the Irish revolutionists in America.

EGBERT, considered the first king of all England, was of the royal family of Wessex. He succeeded Brihtric in 802 as King of Wessex. He reduced the other kingdoms and rendered them dependent on him in 829, thus becoming their overlord. He died in 839.

EGG, a body specially developed in the females of animals, and in which, by impregnation, the development of the young animal takes place. Birds, reptiles, fishes, insects, and worms are oviparous, i. e. bring forth eggs or ova, as do also, among mammalia, the ornithorhynchus and echidna. The egg contains the germ of the young animal, as well as the substance which serves for its nourishment. All it needs for its development is external heat. The eggs of animals lower than the birds have usually only three parts, viz. the germinal spot or dot, the germinal vesicle, and the vitellus or yolk; the first being contained in the vesicle, and that again in the yolk. Besides these parts the eggs of birds have the white or albumen, and the shell, which consists of a membrane coated with carbonate of lime. The eggs of birds, especially of fowls, are a pleasant and nutritive food. The common domestic fowl, the turkey, the peahen, and the common duck produce the the eggs which are commonest in the market. Among reptiles, turtle produce eggs which are good for eating. The eggs of fishes are their roe or spawn.

EGGLESTON, Edward, an American novelist, born in Indiana in 1837, died in 1902. In 1870 he was made literary editor of the New York Independent, and was later editor of the Hearth and Home. Eggleston's works, such as the Hoosier Schoolmaster, The Mystery of

THE EVOLUTION OF A HEN'S EGG.

Metropolisville, The Circuit Rider, and other tales, are full of originality and power and occupy an unique place in literature.

EGGLESTON, George Cary, an American writer and editor, born in Indiana in 1839. He has served as the editor of numerous newspapers since 1870 and has published several volumes of historical memoirs and a number of novels.

EGG-NOG, a drink consisting of the yolk of eggs beaten up with sugar, and the white of eggs whipped, with the addition of wine or spirits.

EGG-PLANT, an herbaceous plant, from 1 foot to 18 inches high, with large white or purplish flowers. The fruit is

Egg-plant.

about the size of a goose's egg, and generally yellow, white, or violet, and when boiled or stewed is used as an article of food.

EG'LANTINE, one of the names of the sweet-briar, a kind of wild rose. The name has sometimes been erroneously used for other species of the rose and for the honeysuckle.

E'GOTISM, as a philosophical doctrine, the view that the elements of all knowledge and the reality of the things known are dependent on the personal existence of the knower. Hence the logical position of the egotist is to doubt the substantial reality of everything except his own existence.

EG'RET, a name given to those species of white herons which have the feathers of the lower part of the back

American great white egret.

elongated and their webs disunited, reaching to the tail or beyond it at certain seasons of the year. Their forms are more graceful than those of common herons. The American egret is about 37 inches long to the end of the tail; plumage soft and blended; head not crested; wings moderate; the tail short, of twelve weak feathers. The European egret is about 40 inches long, of a pure white plumage; the bill is black or dark brown, yellow at the base and about the nostrils, and the legs are almost black. The little egret is about 22 inches long from bill to end of tail, the plumage is white.

EGYPT (ē'jipt), a country in the northeastern part of Africa, governed by a ruler (the khedive or viceroy) who pays tribute to the sultan of Turkey, but is virtually independent. Egypt is bounded on the n. by the Mediterranean Sea, on the e. by Arabia and the Red Sea, and on the w. by the Libyan Desert. Its natural southern frontier may be placed about Assouan (about 500 miles south of the Mediterranean), near which cultivated land almost disappears and the country begins to assume the features of the Nubian Desert. Another point at which the southern boundary has been placed is the second cataract of the Nile at Wady Halfa (about 670 miles south of the Mediterranean), which is the limit of free navigation for larger vessels. Farther south lies the extensive region known as the Egyptian Soudan. This territory was acquired by conquest and occupied for many years previous to the Mahdist revolt of 1883, but the success of the rebels led to its evacuation. Lord Kitchener's expedition in 1897–98, however, regained the country for Egypt. On the Red Sea littoral the farthest point south under the Egyptian flag is Suakin. A small strip of n. w. Arabia on the east of the Red Sea belongs to Egypt, as also the Sinaitic peninsula and the Isthmus of Suez. The area is about 394,000 sq. miles (only some 13,000 being inhabited), with a population of 9,734,405. The capital and largest town is Cairo, the next largest and chief seaport is Alexandria.

The inhabited portion of Egypt is mainly confined to the valley of the Nile, which, where widest (at the Delta), does not exceed 80 miles, and narrows steadily as we ascend its stream till, at the southern frontier, it is only 2 miles wide. The Nile has no tides, but runs constantly toward the sea at the rate of 2½ to 3 miles an hour. After it enters Egypt it flows in a northward direction but with considerable bends till it reaches lat. 30° 15′, a little beyond Cairo, where it divides into two main streams, the Rosetta and Damietta branches, which inclose that portion of land known as the Delta and formed by deposits of alluvial matter. Bordering on the Mediterranean are several salt lakes or lagoons, Menzaleh being the largest, through which is carried the Suez Canal, connecting the Mediterranean and the Red Sea; and also passing through other salt lakes; about 150 miles south of the Mediterranean is the lake Birket-el-Kurun, fed by the Nile. As very little rain falls in Egypt, the prosperity of the country entirely depends upon the Nile, and especially upon the yearly overflow of the river, which so fertilizes the soil with a brown slimy deposit that it produces two crops a year. Beyond the limits of the inundation and of irrigation there is no cultivation whatsoever. The Nile begins to rise in June, and continues to increase until September, overflowing the low lands along its course, the waters being conveyed by canals where natural channels fail. The Delta then looks like an immense marsh interspersed with islands, villages, towns, and plantations, just above the level of the water. After a few days the water begins to subside, and leaves the land again dry about the end of October. The seed is then sown, and artificial irrigation is maintained by water raised from the river, and distributed by means of channels throughout the fields. The appliances for raising water are simple and primitive; chiefly the shadoof worked by two men, and the sakieh driven by a donkey or an ox. The land is soon covered with green crops, and the first harvest is in March.

Chandler's shops, Lower Egypt.

The atmosphere in Egypt is extremely clear and dry, the temperature regular and exceedingly hot. The winter months are the most delightful part of the year;

later, the ground becomes parched and dry, and in May the suffocating khamseen, or simoom, begins to blow from the desert plains. Rain is scanty except near the sea-shore; but at night the dews are heavy in lower Egypt, and the air cool and refreshing. Egypt is not remarkably healthy, as, in addition to visitations of plague and cholera, opthalmia, diarrhæa, dysentery, and boils are very prevalent.

Now as formerly there is little timber, the principal trees, besides the date-palm and tamarisk, being the sycamore fig, and acacia or gum-arabic tree. The papyrus plant, once so important, is now to be found only in one or two spots. Of it was manufactured a paper which was supplied to all the ancient world. Beside the lotus or water-lily of the Nile, Egypt has always been celebrated for its production of corn, barley, a great variety of the bean class, leeks, garlic, onions, flax, and for plants of the cucumber tribe. To the products of ancient times have been added the sugar-cane, cotton plant, indigo, and tobacco.

In spite of the fact that at least two and sometimes three successive crops may be gathered in a year, agriculture in Egypt is still in a very low state; and the extreme poverty and generally wretched condition of the cultivators render improvement difficult. There are few trades which have attained a development of any importance.

Of the inhabitants of Egypt those of the peasant class, or fellahs as they are called, appear to be descendants of the ancient Egyptians mixed with Arab blood. Having embraced Mohammedanism, they are often denominated Arabs, though regarded by the true Arab with contempt. The Copts are the descendants of the ancient Egyptians who embrace and still cling to the Christian religion. With those aboriginal inhabitants are mingled, in various proportions, Turks, Arabs (chiefly Bedouins), Armenians, Berbers, negroes, and a considerable number of Europeans, especially Greeks and Levantines.

The government of Egypt is in the hands of the khedive or viceroy, who is assisted by a ministry formed on the model of those of Western Europe. The title and government are hereditary, but the khedive, as a Turkish vassal, has to pay an annual tribute to the sultan of about $3,500,000.

The Egyptians are the earliest people known to us as a nation. When Abraham entered the Delta from Canaan they had been long enjoying the advantages of a settled government. They had built cities, invented hieroglyphic signs, and improved them into syllabic writing, and almost into an alphabet. They had invented records, and wrote their kings' names and actions on the massive temples which they raised. The arrangement of Egyptian chronology is still a much-disputed point among scholars. A list of the kings of Egypt, arranged in 30 dynasties was given by the priest Manetho about 250 B.C., and this division is still used. Egyptologists go back as far as 5,702 years before Christ, and trace the founding of Egypt by Mena, about that date, with the building of its capital, Memphis. The chronology carries down with more or less breaks through the various dynasties until the conquest of Egypt in 332 B.C. by Alexander the Great. Egypt became a Greek state, subsequently a Roman province, and finally in 640 A.D., a mere territory of the Mohammedan power which it remains to the present day. Its glories are all in its ancient civilization. This cilivization of the Egyptian had reached a high pitch from the earliest period to which we can trace their history. The masonry of the passages in the great pyramid has not been surpassed at any age. More than 2000 B.C. the Egyptians had duodecimal as well as decimal numbers; weights and measures adjusted to a pound of 1400 grains. In mechanical arts the carpenter, boat-builder, potter, leather-cutter, glass-blower, and others are frequently represented on their ancient monuments, and we see the blow-pipe, bellows, and siphons; the press, balance, lever; the saw, the adze, the chisel, the forceps, the syringe, harpoon, razors; we have also glazed pottery, the potter's wheel, and the kiln; and dated specimens of glass of the time of Thothmes III., 1445 B.C. Gold-beating, damascening, engraving, casting, inlaying, wire-drawing, and other processes, were practiced. The processes of growing and preparing flax, as well as the looms employed, are all depicted. The social and domestic life of the ancient Egyptians is pictured for us on the walls of their temples and tombs. The rich spent much of their time in hospitality and entertainments, especially of a musical kind. In the country districts the superintendence of the agricultural works or the fisheries on their estates was varied by the sports and pleasures of a country life. The lower orders were poor and uneducated, scantily fed and clothed, and held in contempt by the higher classes. But there was no strict separation into caste; and although the priests form a ruling bureaucracy, the highest posts were open to the successful scholar Next to the priesthood in importance was the military class or order, who were all landholders and bound to serve in time of war. Below these were the husbandmen, who paid a small rent to the king. Egyptian custom seems to have allowed but one wife, who occupied an honorable and well-established position as the "lady of the house"

The two main principles on which the religion of Egypt was based appear to have been the existence of an omnipotent Being, whose various attributes being deified, formed a series of divinities; and the deification of the sun and moon. Each group of divinities formed a triad composed of a chief male deity, with a wife or sister and a son, as Osiris, Isis, and Horus, or Amun, Maut, and Khonso. Among the other gods of the Egyptian Pantheon are Ra, the sun, usually represented as a hawk-headed man. Mentu and Atmu are merely two phases of Ra, the rising and the setting sun. The worship of the bull Apis is connected with Osiris. Serapis is the defunct Apis, who has become Osiris. Seth or Set represents the power of evil. Ammon (Egyptian Amen), originally a local god, owed his importance to the greatness of his city, Thebes. Thoth is the chief moon-god, and is generally represented as ibis-headed. Anubis, the jackal-headed, belonged to the family of Osiris, and presided over mummification. Besides these deities the Egyptians worshiped beasts, reptiles, and even vegetables, probably as symbols. The Egyptians believed in the transmigration of souls and in the existence of a future state, in which mankind would be rewarded or punished according to their actions while on earth.

The monuments we have left to us in Egypt are of two main periods—those

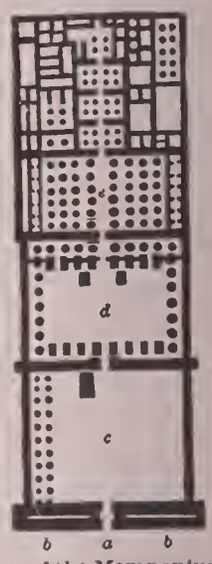


Fig. 1 Plan of the Memnonium, Thebes.

built in the times of the Paraohs or native kings, and those built during the rule of the Greeks and Romans (subsequently to 330 B.C.). The former

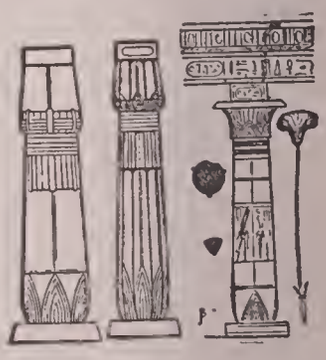


Fig. 2. Types of Egyptian columns.

period was by far the longer and more important, and to it belong the most characteristic examples of Egyptian architecture and sculpture, such as pyramids, vast temples, some of them cut in the solid rock (as at Ipsambul), rock-cut tombs, gigantic monolithic obelisks, and colossal statues. The characteristic features of the style are solidity, boldness, and originality. Among its peculiar characteristics may be noted—symmetry of structure; the gradual converging of the walls of some of its edifices, especially of the propylæa or tower gateways of its temples; roofs and covered ways being flat, and composed of immense blocks of stone reaching from one wall or column to another, the arch not being employed nor yet

THE SHATTERED PAGEANTRY OF EGYPT'S TEMPLES—SOME OF THE SPLENDOURS OF OLD NILE.

The Great Pylon of the Lunar Deity, Khensu, at Karnak

The Lotus Columns of Luxor Erected in the Reign of Amenhotep III (18th Dynasty, About B.C. 1414-1377)

Flooded Philæ, Once the Summer Resort of Roman Egypt

Spanning a Giant Column at Dendera

Dedicated to Horus Dusk in the Temple Court of Edfu

The Ramesseum, a Great Temple of Rameses II. which Served as a Mortuary Chapel to his Tomb at Thebes

Under the Cliff at Thebes the Temple of a Dispossessed Queen

Ptolemy Crowned by Lower Egypt and Upper Egypt

The Flooded Court of the Temple of Isis at Philæ

EGYPT

timber; columns numerous, close, and massive, generally without bases, and exhibiting great variety in their capitals, from a simple square block to an elaborate composition of palm-leaves or other forms suggested by vegetation Fig. 2);

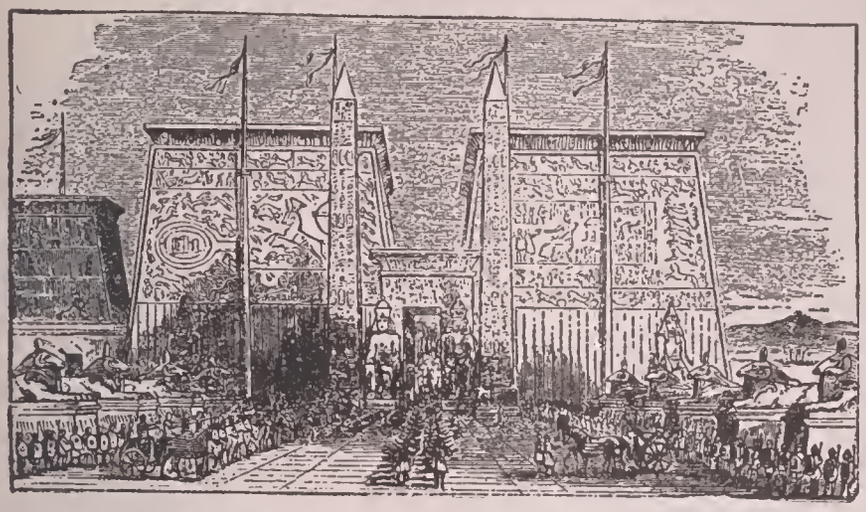


Fig. 3. Restoration of the prodylon or gate of the Temple of Luxor.

the employment of a large concave molding in the entablature, decorated with vertical flutings or leaves; walls and columns decorated with a profusion of

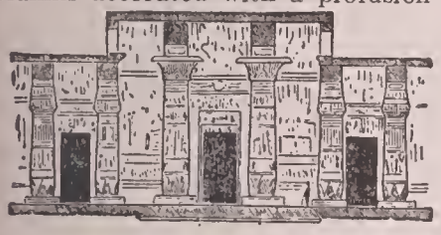


Fig. 4. Hall of columns in the Memnonium—Time of the Pharaohs.

sculptures in outline or low relief representing divinities, men, and animals, with innumerable hieroglyphics, brilliant coloring being often superadded. One remarkable feature associated with

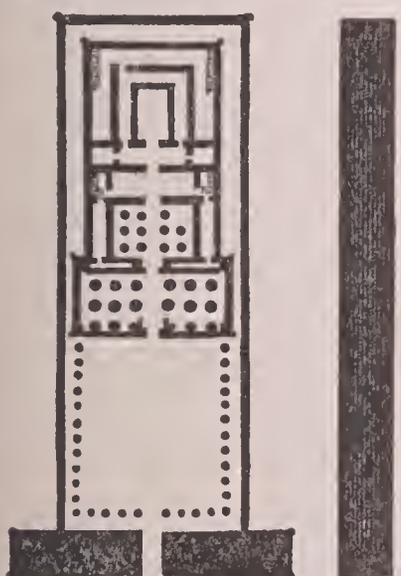
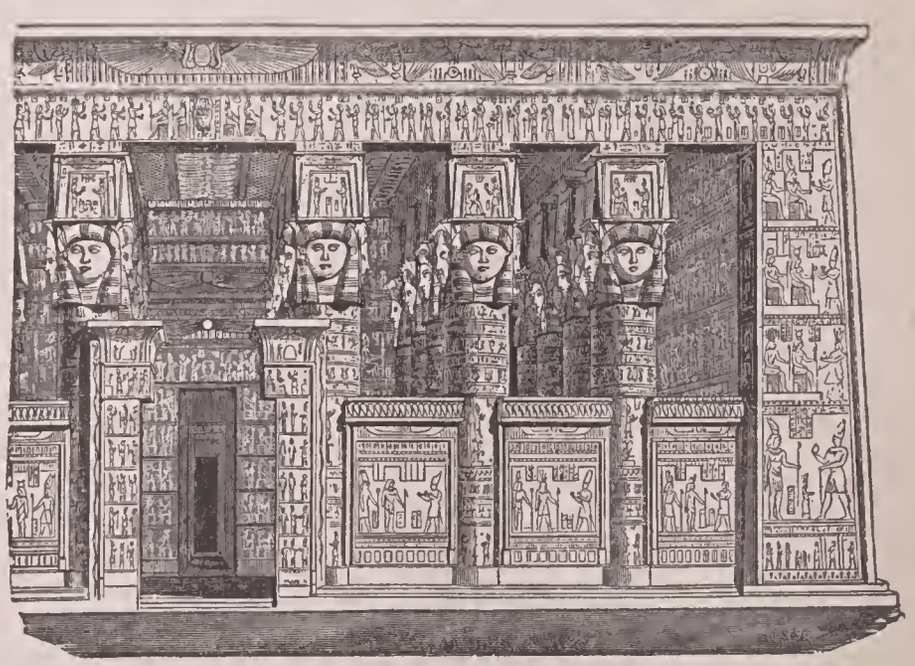


Fig. 6. Plan of Ptolemaic temple at Edfou.

this style is the grandeur of its mechanical operations in cutting, polishing, sculpturing, and transporting vast blocks of limestone and of granite. The pyramid is one of the best-known forms of Egyptian art, and there is little doubt that these structures were intended as the tombs of kings. The leading features of the Egyptian temples were these: a gateway flanked by two lofty pylons (Fig. 3) formed the entrance to a square court (see Fig. 1, a entrance, b b pylons, c court). From this court the way leads through a second gateway to an inner court (d), surrounded by a colonnade. Beyond this is the chamber of the temple known as the Hall of Columns (Fig. 1 e, and Fig. 4), the center avenue of which was higher than the rest of the hall, and consisted usually of twelve columns, which supported a flat roof formed of massive stones, light being admitted at the sides of this elevated portion. To the Hall of Columns succeeded a series of smaller chambers, the roofs of which were generally supported by six or four columns. These apartments frequently surrounded a dark chamber—the most sacred in the temple—the holy of holies. The surface of each architectural feature was engraved with its particular ornament appropriately colored. In the cavetto, or hollow molding of the cornice, it was customary to place the name and titles of the Pharaoh or king; the architrave stone was symbolically ornamented with the names of the divinities to whom the temple was dedicated, and of the sovercign in whose time it was built. The abacus of the column was invariably decorated with the royal titles. The capitals were painted in accordance with the intention of the form; if, for instance, the expanded papyrus was shown, the leaves of the calyx would be yellow and the filaments green. Beneath were horizontal bands of blue and white, and then a representation of the king offering gifts to the gods of the temple; and lastly, the yellow and red lines at the base of the shaft signified the brown leaves that envelop the base of the stalk of the natural plant, The Egyptian temple was invariably rectangular, with its walls inclining inward, and never more than one story high, and the approach to it was frequently

Sphinx and pyramid.

through an avenue of sphinxes Fig. 3). The temples built during the sway of the Greeks and Romans, though having a general resemblance to the earlier ones, differed in some respects, as in the use of more elaborate capitals, more salient forms in the architectural and sculptural decorations, etc. (The Ptolemaic temple is shown in Fig. 6.) A peculiar kind of mural sculpture was



Temple of Denderah.

practiced among the Egyptians, the outline of the object to be represented being cut into the surface, while the minor forms and rotundity are shown

within this incised outline, thus forming a kind of "hollow relief." For further illustrations of Egyptian architecture, see Architecture, Esneh, Karnak; and for an account of the hieroglyphics of ancient Egypt see Hieroglyphics.

EGYPTIAN BEAN, a name sometimes given to the bean-like fruits of the Nelumbium speciosum, or sacred lotus, found in China, India, Australia, but no longer on the Nile.

EGYPTIAN BLUE, a brilliant pigment consisting of the hydrated protoxide of copper mixed with a minute quantity of iron.

EGYPTIAN VULTURE, a bird that frequents both shores of the Mediterranean, but rarely passes farther north, though it has been found in the British islands. It is one of the smaller vultures, about the size of a raven. The general color is white, the quill feathers of the wing being dark brown. It frequents the streets of eastern towns, where it is protected on account of its services as a scavenger.

EGYPTOLOGY, the science of Egyptian antiquities, or that branch of knowledge which deals with the language, history, etc., of ancient Egypt.

EIDER DUCK, a species of duck found from 45° north to the highest latitudes yet visited, both in Europe and America. Its favorite haunts are solitary rocky shores and islands. In Greenland and Iceland they occur in great numbers, and also breed on the western islands of Scotland. The eider duck is about twice the size of the common duck, being about 2 ft. 3 in. in length, 3 feet in breadth of wing, and from 6 to 7 lbs. in weight. The male is black, head and back white, with a black crown. The female is reddish drab spotted with black, and with two white bands on the wings. They feed largely on shellfish, crustaceans, etc. Their nests are usually formed of drift grass, dry seaweed, etc., lined with a large quantity of down, which the female plucks from her own breast. In this soft bed she lays five eggs, which she covers over with a layer of down. If this, with the eggs, is removed the bird repeats the process. One female generally furnishes about ½ lb. of down, but the quantity is reduced by cleaning. This down, from its superior warmth, lightness, and elasticity, is in great demand for beds and coverlets; and the districts in Norway and Iceland where these birds abound are guarded with the greatest vigilance as a most valuable property. As found in commerce this down is in balls of the size of a man's fist, and weighing from 3 to 4 lbs. It is so fine and elastic that 5 lbs. of the best quality is sufficient for a whole bed. The down from the dead birds is little esteemed, having lost its elasticity. The king eider duck is another species resembling the preceding and inhabiting the same coasts.

Eider duck.

EIFFEL, Alexandre Gustave, a French engineer, designer of the Eiffel Tower at Paris. He was born in France in 1832, and was the designer of several important bridges. The frame work of Bartholdi's statue of Liberty at New York, was planned by M, Eiffel. (See Eiffel Tower).

EIFFEL TOWER, a gigantic steel tower at Paris, the tallest building of any kind in the world. It was erected as a special "wonder" for the Paris Exposition of 1889 by Alexandre Gustave Eiffel (which see). Its total height is 984 feet. It is built of four great piers, merging into one at a height of 620 feet from the ground. On various levels are great floor areas for entertainment, observation, and refreshment the first of these having an area of 38,000 square feet. Seven thousand tons of steel were used in the construction of the tower, at a cost of upwards of $1,000,000. From the top of the tower a view to a distance of 85 miles can be had.

EIGHT-HOUR DAY, a term applied to the ideal working day of the labor unions. It had its origin in England and its greatest growth in the United States, where numerous trades unions have established it as part of their bargain-contracts with employers. The eight-hour working day is established by law for all kinds of government work. Several states and cities have adopted it for their employes, but it is as yet by no means universal in the United States. In Australia the movement has succeeded better than in any other part of the world.

EJECT'MENT, in law, an action wherein the title to lands and tenements may be tried and the possession recovered. It is commenced by a writ addressed to the tenant in possession and all entitled to defend the possession, bearing that the plaintiff lays claim to the property in question, and calling upon all interested to appear within a certain time to defend their right, failing which the tenant in possession will be ejected. In its older form the action was remarkable for certain curious legal fictions on which procedure was based; and the name of John Doe, an imaginary plaintiff, and of Richard Roe, an equally imaginary defendant, were long familiar in cases of this kind in the courts.

Flowering branch of oleaster. *a*, Fruit. *b*, Section of same.

EKAT'ERINOSLAV, a town of southern Russia, capital of a government of the same name, on the right bank of the Dnieper, 250 miles n. e. of Odessa. It was founded in 1787 by Prince Potemkin, and consists of a number of long, broad, and dirty streets. Pop. 46,876.—The government, which is intersected by the Dneiper and at one point reaches the Sea of Azow, mostly consists of steppes; area, 26,140 sq. miles; pop. 1,792,831.

ELÆAGNA'CEÆ, the oleaster family of plants, a small natural order of opetalous oxogens scattered over the northern regions. Several species are cultivated for their silvery scurfy foliage. The silver-berry is a native of northern America.

E'LAND, a species of antelope inhabiting Africa, the largest of all the antelopes being about the size of an ox. Its flesh, especially that of the thighs, which are dried and used in this state, is highly prized, and consequently the animal is now nearly exterminated in the neighborhood of Cape Colony, where it was once common. The color is a light or grayish brown, and it possesses a short mane. The horns, which are about 18 inches long and nearly straight, are spirally keeled.

Eland.

ELASMOBRANCHII (-brang'ki-ī), an order of fishes, including the sharks, skates, and chimæra, in which the skull is not composed of distinct bones, but simply forms a kind of cartilaginous box, the vertebral column sometimes cartilaginous, sometimes consisting of distinct vertebræ, the integumentary skeleton in the form of placoid scales, the intestines being very short, and provided with a spiral valve. They have two pairs of fins (pectorals and ventrals), two responding to the fore and hind limbs, and the ventral fins are close to the anus. The heart consists of an auricle, a ventricle, and a muscular arterial bulb. The gills are fixed, and form a number of pouches, which open internally into the pharynx, communicating outwardly by a series of apertures placed on the side of the neck.

ELAS'MODON, a sub-genus of the genus Elephant, under which are included the mammoth and Asiatic species, the African elephant belonging to the sub-genus Loxodon.

ELASTIC'ITY is the property in virtue of which bodies resist change of volume and change of shape, and recover their former figure or state after external pressure, tension, or distortion. The former is called elasticity of volume, the

latter elasticity of shape. The name compressibility is also used in connection with the elasticity of volume; and rigidity, or resistance to change of shape in connection with the latter. Fluids possess no rigidity whatever; they offer no permanent resistance to change of shape; while a solid body, unless it is distorted beyond certain limits, called the limits of elasticity, tends to return to its original form. Both fiuid and solids possess elasticity of volume, and tend to resume their original volume after compression. The elasticity of volume of the former is perfect; whatever compression they have been subjected to, they return under the same conditions of temperature to precisely their original volumes when the forces of compression are removed. In the case of solids there are limits to their elasticity of volume as well as to their elasticity of form; thus gold may be made permanently denser by hammering.

ELBA, a small island in the Mediterranean, in the province of Livorno (Leghorn), Italy, separated from the mainland by the Strait of Piombino, about 6 miles wide. The island is 18 miles long and from 2½ to 10½ miles broad, and is traversed by mountains rising to a height of over 3000 feet. It is rich in iron, marble, granite, salt, etc.; and iron ore is exported. Excellent wine and fruits are produced. It has two seaports—Porto-Ferrajo (the capital) and Porto-Longone. The Treaty of Paris in 1814 erected Elba into a sovereignty for Napoleon, who resided in it from May 4, 1814, to February 26, 1815. Pop. 24,000

ELBE, river of Germany, one of the largest in Europe. It rises on the s.w. slopes of the Schneekoppe or snowcap, one of the Riesengebirge, between Bohemia and Silesia. From this point it flows nearly due s. into Bohemia for about 50 miles, when it turns to the w., and after about 40 miles takes a general n.n.w. direction till it falls into the North Sea, intersecting Saxony, a considerable portion of Prussia, and in the latter part of its course separating Holstein on its right from Hanover on the left. The length, including windings, is upward of 780 miles. It is more or less navigable for about 470 miles, but its estuary at Cuxhaven is much encumbered with sand-banks. In 1870 its navigation was declared free from Hamburg to Melnik in Bohemia. The North Sea and Baltic ship canal now connects its estuary with Kiel Bay. The Elbe is well stocked with fish.

ELBERFELD (el'bêr-felt), a town of Rhenish Prussia, in the government of and 15 miles e. of Düsseldorf, on both sides of the Wupper, inclosed by lofty hills. Taken with Barmen it stretches along the Wupper valley for about 6 miles. Linen, woollen, silk, and mixed goods, ribbons, and velvet are extensively made and exported. There are numerous mills for spinning cotton twist, linen yarn, and worsted, and numerous dye-works, and miscellaneous industrial establishments. The environs are almost entirely taken up with bleach-fields. Pop. 156,937; with Barmen, 298,884.

ELDER, a name given to different species of small trees or shrubs, with opposite and pinnated leaves, bearing small white flowers in large and conspicuous corymbs, small berries of a black or red color, and bitter and nauseous leaves possessing purgative and emetic properties. The wood of the young shoots contains a very large proportion of pith. The common elder is a wild shrub or small tree, distinguishable by its winged leaves; its clusters of small, cream-white flowers, and the small black berries by which these are succeeded, and from which a kind of wine is sometimes made. Two species inhabit N. America: a common plant from the 49th to the 30th parallel of latitude, the berries of which are black and have a sweet taste; and one which bears red berries, and inhabits Canada, the northern parts of New England, and the Alleghany Mountains. Elder wood is yellow, and in old trees becomes so hard that it is often substituted for box-wood. Its toughness also is such that it is made into skewers, tops for fishing-rods, etc. The light pith is utilized for balls for electric experiments, and various ointments, drinks, and medicinal decoctions are made from the bark, leaves, flowers, and berries.

ELDERS, persons who, on account of their age, experience, and wisdom, are selected for office, as, among the Jews, the seventy men associated with Moses in the government of the people. In the modern Presbyterian churches elders are officers who, with the pastors or ministers, compose the consistories or kirk-sessions, with authority to inspect and regulate matters of religion and discipline in the congregation.

EL DORA'DO, a country that Orellana, the lieutenant of Pizarro, pretended he had discovered in South America; and between the Orinoco and Amazon rivers; and which he named thus on account of the immense quantities of gold and precious metals which, he asserted,he had seen in Manoa, the capital of the country.

ELECTION, in politics the choosing of public officials by the vote of the electors (persons having the suffrage right). In the U. States elections may be direct, as in the case of congressmen, legislators, judges, etc., or indirect, as in the case of U. States senators and the president, the former being chosen by the state legislatures and the latter by an electoral college (which see). Candidates are named in various ways, or may be self-constituted, and the law in many instances recognizes the machinery by which candidates are chosen. The various states have various laws regulating elections and contests of elections. All contested elections, however, are always decided by party considerations and not by justice—unless party considerations be considered as being sufficiently just.

ELECTION, in theology, the doctrine that God has from the beginning elected a portion of mankind to eternal life, passing by the remainder. It is founded on the literal sense of certain passages of Scripture, and has been amplified by the labors of systematic theologians into a complete and logical system. It dates in ecclesiastical history from the time of Augustine; but Calvin has stated it so strongly and clearly in his Institutes, that it is generally associated with his name.

ELECTIVE STUDIES, studies which are optional with the student in an educational institution. In American universities a certain number of specific studies are "required" for a degree. Thus for the A.B. degree the candidate is required to do a definite amount of work in the languages, history, etc., but he is given a choice as to the kind of work he will do within certain limits. Elective studies have been found to be very efficient in stimulating interest, as they enable a candidate for a degree to select the branches in which he is most interested. The system, however, has many eminent opponents.

ELECTOR, the title of certain princes of the old German Empire who had the right of electing the emperors.

ELECTORAL COLLEGE, in the U. States the body of the electors chosen by the people to vote for the president. The people vote not for their favorite candidate for president but for the candidate for elector who invariably votes for the head of the party ticket. This fact shows how really little force the American constitution has upon the will of the people. In effect it is the popular vote that elects the president, not the vote of the electors. The electors of each state meet, vote by ballot for the president and vice-president, and after being signed by the governor the vote is sent to the president of the U. States senate and counted in the presence of both houses of congress. All this work, however, is merely formal, the result of the election being known as soon as the popular vote is known.

ELECTORAL COMMISSION, a body of men empowered by congress in 1877 to settle the electoral votes of Florida, Louisiana, Oregon, and South Carolina, in the presidential election of 1876. These four states presented conflicting certificates and congress could not agree. The commission consisted of five senators, five representatives, and five members of the supreme court. The commission found that Hayes and Wheeler had been elected over Tilden and Hendricks by a majority of one electoral vote.

ELECTRICAL FISHES, a name given to fishes possessing the property of communicating an electric shock when touched with the hand or any electric conductor. One of the best known is the electric eel, a native of South America. It is of nearly equal thickness throughout; head and tail obtuse; ordinary length, 3½ to 4 feet. The seat of the four electrical organs is along the under side of the tail, and they are said to possess the power of knocking down a man, and of painfully numbing the affected limb for several hours after the shock. After a few discharges, however, the faculty of producing a shock is impaired, and an interval of rest is required for a new storage of force.

ELECTRIC BATTERY, the original name of what is now more commonly called a battery of Leyden-jars, the old name having been given before galvanic

batteries were invented. See Leyden-jar.

ELECTRIC CLOCK, a clock driven or controlled by electrictity, the latter being the ordinary meaning of the term. One clock driven in the ordinary way can be made to control by electric currents another clock (or clocks) also driven in the ordinary way so as to make it keep accurate time. By means of it one high-class clock (usually in an astronomical observatory) compels a number of other clocks at considerable distances to keep time with it. The clocks thus controlled ought to be so regulated that if left to themselves they would always gain a little, but not more than a few minutes per day. The pendulum of the controlling clock, in swinging to either side, makes a brief contact, which completes the circuit of a galvanic battery, and thus sends a current to the controlled clock. The currents pass through a coil in the bob of the pendulum of the controlled clock, and the action between these currents and a pair of fixed magnets urges the pendulum to one side and to the other alternately. The effect is that, though the controlled clock may permanently continue to be a fraction of a second in advance of the controlling clock, it can never be so much as half a second in advance. An electrically-controlled clock usually has close beside it a small magnetic needle, which moves to the one side or the other according to the direction of the current, and thus shows whether the currents are coming. The arrangements are usually such that at every sixieth second (that is at every exact minute) no current is sent, and the needle stands still. Any small error is thus at once detected.

ELECTRIC HEATER, a device used to convert an electric current into heat for the purpose of heating a house, an apartment, or an interior. The heater consists of coils of metal, placed in a box containing air which, on the passage of the current through the coils, thus heating the coils, becomes itself hot and heats the air surrounding the box. Numerous variations of this idea have been patented, nearly all of which are satisfactory. Electric heating is the ideal system for warming houses of any kind, but its expense prevents its general adoption.

ELECTRIC'ITY, the name given to the unknown cause of certain effects of very various kinds which are found to be closely connected one with another. They include two distinct kinds of attraction and repulsion (electrostatic and electrodynamic), the magnetization of iron, the deflection of magnetic needles, the production of heat and light in certain circumstances, the separation of certain chemical compounds into their constituents, and spasmodic actions on the nervous and muscular systems of animals. The name is derived from the Greek ēlectron, amber, the fact that amber when rubbed attracts light particles, such as small pieces of paper, having been known to the ancient Greeks. Friction was the only artificial source of electricity employed until Galvani, near the close of last century, accidentally obtained it by the contact of two metals with the limbs of a frog; and Volta, developing Galvani's discovery, invented the first galvanic or voltaic battery. Electricity produced by friction is called frictional electricity; that produced by chemical action on metals, voltaic electricity.

All substances which, like amber, could be made to show electrical attraction by rubbing them, were called electrics by early writers on electricity. They included glass, amber, sulphur, shellac, rosin, silk, flannel, etc. The name non-electrics was given to other bodies which were supposed not to be susceptible of excitation by friction. The bodies called non-electrics were also called conductors, from the power which they exhibited of allowing electricity to pass through them. Electrics were also called non-conductors. The names conductor and non-conductor are still retained, but the names electric and non-electric are discarded as being founded on a mistake. Electricity can be excited by the friction of a conductor against a non-conductor, and is, in fact, so excited in the ordinary electrical machine, in which glass rubs against an amalgam spread on a cushion. A metallic rod furnished with a glass handle can be electrified by rubbing it with flannel, the glass preventing the electricity from being conducted away through the hand. Substances thus electrified exhibit two opposite kinds of electricity, known respectively as positive and negative. Bodies charged with the same kind of electricity repel each other; those charged with opposite kind attract each other. An instrument for indicating the presence of electricity is called an electroscope.

All solid and liquid substances allow electricity to pass through them to some extent, but the differences of degree are enormous. The best conductors are the metals, especially gold, silver, and copper. Perfectly pure copper conducts about seven times as well as iron. Substances which have excessively small conducting power are not called conductors, but insulators, so that a good insulator is another name for an excessively bad conductor. Among the best insulators may be mentioned glass, paraffin (the wax, not the oil), ebonite, shellac, mica, india-rubber, and gutta percha. The ratio of the conducting power of a metal to that of one of these substances is about a thousand million billions to one. Water occupies an intermediate position between these two extremes. In experiments with frictional or influence machines it behaves as a conductor, but in experiments with galvanic batteries it behaves as an insulator. The word resistance is used in the opposite sense to conducting power; a good insulator is said to have high resistance, and a good conductor to have low resistance.

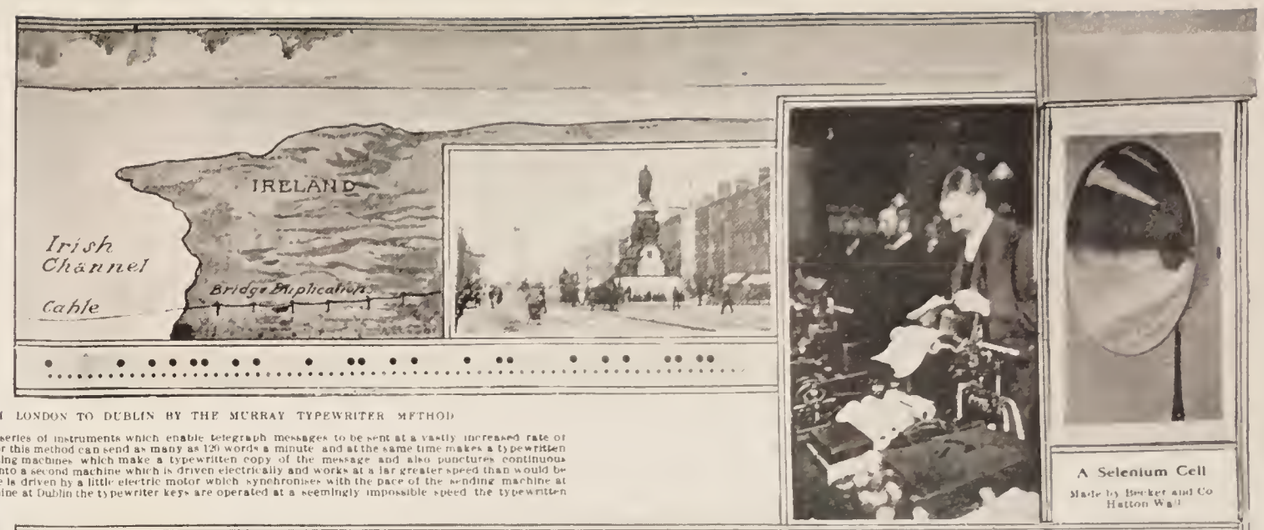
Electrostatics is that branch of the general science of electricity which treats of the repulsions between like and the attractions between unlike kinds of electricity. The fundamental law of electrostatics is that if e and é denote two quantities of electricity collected in two spaces very small in comparison with the distance between them, the mutual force which they exert upon each other is directly as the product eé, and inversely as the square of the distance. If the two quantities eé are both positive, or both negative, the force is a repulsion; but if one is positive and the other negative, it is an attraction. Electrostatic attractions and repulsions manifest themselves in two distinct ways, namely, (1) as attractions and repulsions between electrified bodies; (2) as producing changes in the distribution of electricity on conductors. This second effect is called electrostatic induction. The different portions of the charge of one and the same conductor act upon one another according to the general law of repulsion, and thus produce the actual distribution, which is entirely on the surface, all electricity being repelled from the interior. The interposition of an insulating substance between two quantitities of electricity alters the amount of the forces which they exert upon each other. In a broad sense electrostatics may be held to include within its range all the phenomena of frictional electricity and of the electricity produced by influence machines, such as those of Holtz, Voss, and Wimshurst.

The rapid escape of electricity from a charge body is an electric discharge. When the discharge takes place through a conductor it is called continuous, and when it takes place through a non-conductor (for example through air) it is called a disruptive discharge. The name "electric discharge" is especially applied to cases in which the escaping electricity produces luminosity. Three kinds of such discharge have been distinguished—the spark, the brush, and the glow. The spark is accompanied by a sound which varies from a faint crack to a loud bang. In nature it is seen on the largest scale in the case of lightning, which is a discharge of atmospheric electricity. In many cases the electric spark presents no definite shape, but looks like a mere point of fire, or, if very bright, is enlarged by its dazzling effect on the retina; but when it leaps across a space of several inches of air it assumes a crooked shape bearing a remarkable resemblance to a flash of lightning. The brush discharge is only faintly luminous. It occurs especially at sharp points and edges of highly-charged bodies. It is barely visible by daylight, and its appearance in the dark is that of a luminous halo. It projects only a small distance into the air surrounding the body from which the charge is escaping. The glow discharge simply renders the surface of the body luminous, and does not extend into the air at all. In some modern electric apparatus beautiful effects of electric discharge are shown. Thus by causing a discharge to take place in highly-rarefied air or gas it is made to jump across a considerable interval, and the whole intervening space is filled with a beautiful nebulous luminosity, the color of which depends on the nature of the gas. If the vacuum is sufficiently good the luminosity is seen to be disposed in transverse stripes, technically called striæ.

An electrified body left to itself gradually loses its electricity. This effect

Working the Punching Machine

which makes the holes in the paper band

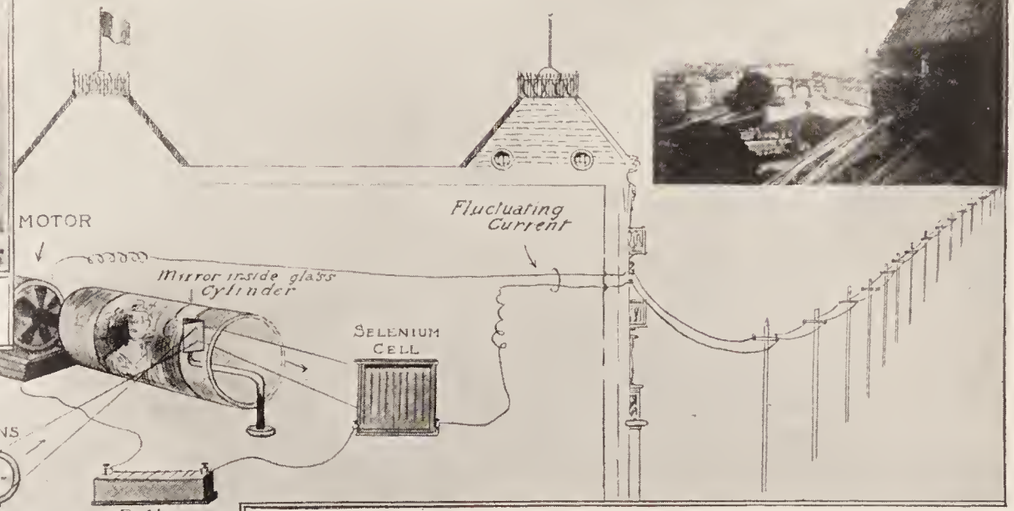


A Selenium Cell

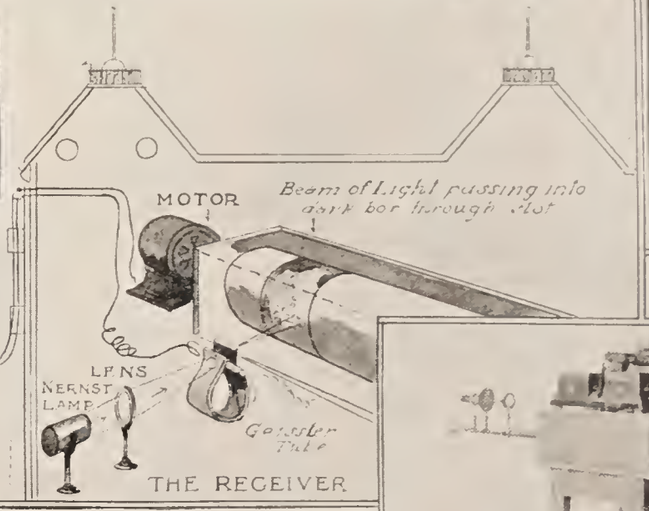
Made by Becker and Co Hatton Wall

HOW 120 WORDS A MINUTE CAN BE TELEGRAPHED FROM LONDON TO DUBLIN BY THE MURRAY TYPEWRITER METHOD

The post office authorities have installed at the Central Telegraph Office in London a series of instruments which enable telegraph messages to be sent at a vastly increased rate of speed. Instead of about forty words a minute being tapped off by a telegraphic operator this method can send as many as 120 words a minute and at the same time makes a typewritten copy of the message. Messages which are to be sent are typewritten on special typewriting machines which make a typewritten copy of the message and also punctures continuous bands of paper by means of a series of five little puncturing rods. The strip is then fed into a second machine which is driven electrically and works at a far greater speed than would be possible with human fingers. At the Dublin end of the wire a similar typewriting machine is driven by a little electric motor which synchronises with the pace of the sending machine at the Central Telegraph Office in London. As the punctured tape passes through the machine at Dublin the typewriter keys are operated at a seemingly impossible speed the typewritten message appearing on paper almost quicker than one can read it.

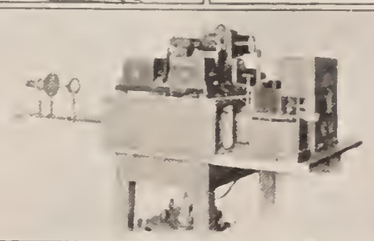


THE KORN TRANSMITTER



Enlarged Photograph

Sent by electricity

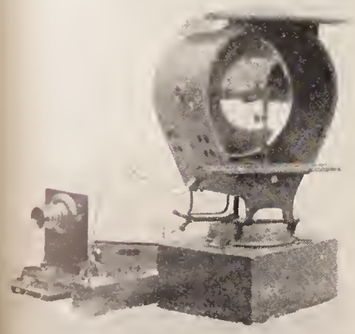


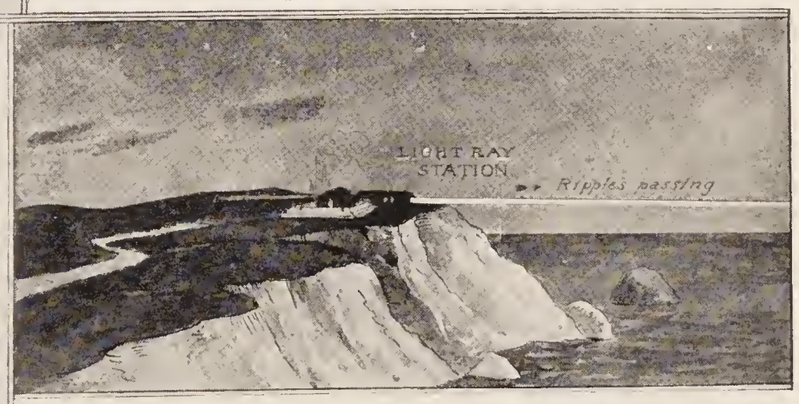
The Kern Receiving Apparatus

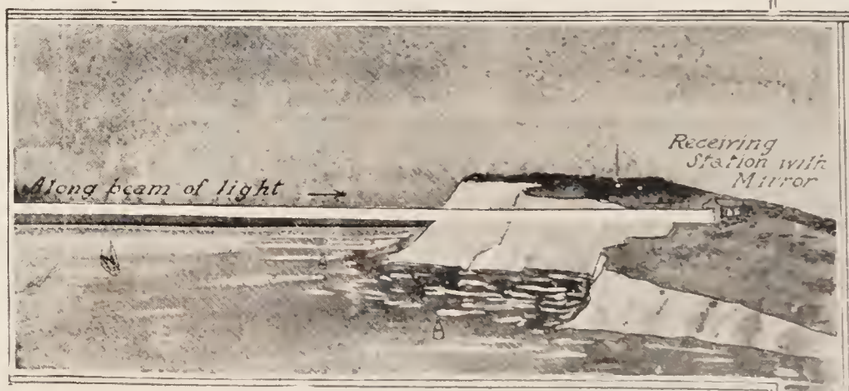
Showing Nernst lamp lens motor and dark box

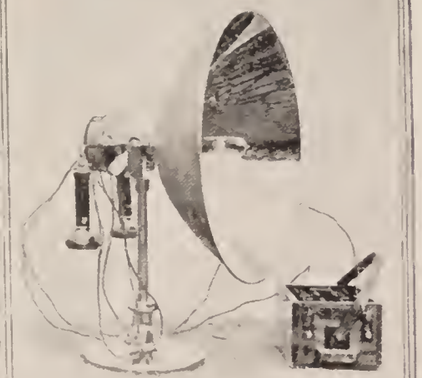
A MARVELLOUS TRANSMISSION OF PHOTOGRAPHS FROM ONE DISTANT CITY TO ANOTHER

This result has been obtained by a subtle use of a rare metal, selenium, which possesses the quality of being electrically sensitive to light in a marked degree. If a selenium cell is placed in an electric circuit only a very small amount of current will flow through the cell, but directly a ray of light falls on the selenium the resistance which it makes to the current breaks down and the current flows through. It is as if a little gate were opened and shut by the application of a light ray. Professor Korn makes a transparent positive from a photograph and applies this to a revolving glass cylinder, which is driven by a small electric motor on a screw thread which gradually advances the cylinder at the same time as revolving it. The light from a Nernst lamp is then concentrated onto the glass cylinder. As the cylinder revolves the ray passes through the various portions of the photograph the dark parts of the positive blocking the light. A fluctuating ray of light is therefore thrown onto the little mirror inside the cylinder and from thence projected onto the selenium cell which lets through a varying amount of current in proportion to the light it receives. In the receiving station the process is reversed.









THE NEW METHOD OF SENDING A TELEPHONE MESSAGE BY A RAY OF LIGHT

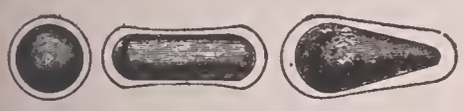
It is now possible to actually reproduce a message from one point to another by means of a ray of light reproducing at the end of the ray the tones of the voice as it were into the ray at the sending end. Numerous experiments have been made, and it has been found possible to combine a microphone with a powerful electrical searchlight in such a way that the powerful current operating the searchlight is made subject to small fluctuations. It is as if a series of ripples were sent along the continuous band of light waves sent out by the powerful arc light. At the other end of the shaft of light is fixed the polished mirror as shown in the annexed photograph, in the center of which is a selenium cell similar in nature to the cell used in the transmitting of the Kern photographs. The fluctuations of light are concentrated by the concave mirror on the cell, and the little diaphragm attached to the receiver is operated by the fluctuating currents, and sounds reach the ear just as they do in the case of the ordinary telephone. It is just as if you had spoken along the beam of light from a lighthouse tower and someone had heard you at the other end of the ray about ten miles away.

THREE NEW AND MARVELOUS METHODS OF CONQUERING SPACE BY ELECTRICITY

HOW MODERN MECHANICAL SKILL IS ABLE TO OVERCOME TIME AND SPACE BY ADAPTION OF ELECTRICAL CURRENTS WITH RARE METALS WITH STRANGE CAPACITIES

is due to more causes than one. If the body is a conductor and has any sharp points or edges, these afford a ready channel for the escape of the charge into the air. Some loss occurs by particles of dust in the air being attracted to the body and then repelled after coming in contact with it. But the chief loss in the case of a smooth conductor on insulating supports usually occurs by leakage over the surface of the supports, owing to a thin film of moisture from which it is difficult to keep them free. This is especially the case with glass supports. Dissipation can be almost completely prevented by surrounding the electrified body with an artificially dried atmosphere. The most usual means of doing this is to place a shallow dish of sulphuric acid in the closed vessel in which the body is contained. The loss by dissipation can thus be reduced to one or two per cent of the entire charge per diem.

When a conductor has a permanent charge, there is no electricity in its interior. The charge resides entirely at the surface, and is not distributed equally over the whole surface but is thickest (so to speak) at those parts which project most. The dotted lines in



Distribution of electricity—Relative amounts on curved surfaces.

figures above illustrate by their distances from the conductor, the thickness (technically called density) of the electricity at the different parts of the surface. At sharp edges, and still more at sharp points, the density is exceedingly great and hence the electricity has a strong tendency to leak away.

What is known as an electric current is a peculiar condition of a wire or other conductor of electricity, in virtue of which it deflects magnetic needles in its neighborhood, magnetizes a piece of soft iron round which is it coiled, has its own temperature raised, and exhibits various other effects. This condition of a wire occurs both in connection with frictional and voltaic electricity, and can be produced by attaching its ends to the two terminals of a galvanic battery, or to the two terminals of a magneto-electric machine, and in various other ways. An electric current may be regarded at pleasure as consisting in the flow of positive electricity in one direction through the wire in question, or of negative electricity in the opposite direction, or of both electricities simultaneously one in each direction. What is conventially called the direction of the current is the direction in which the positive electricity may be regarded as flowing. The "strength" of a current denotes the quantity of electricity that passes through the wire in the unit of time. The deflecting force which a current exerts on a magnetic needle—other things being equal—is proportional to the strength of a current; but the quantity of heat which it generates in a given time is proportional to the square of its strength. One effect of currents is the decomposition of certain chemical compounds, and this effect, like that first mentioned, is simply proportional to the strength of the current. Instruments for measuring the strengths of currents by chemical decomposition are called voltameters, and instruments for measuring them by the deflection of magnetic needles are called galvanometers. The current by which telegraphs are worked are usually obtained from galvanic batteries; but the far stronger currents required for electric lighting are usually produced by machines called dynamos driven by steam or water power. The currents in such machines are due to magneto-electric induction.

Electro-dynamics is that branch of electrical science which treats of the attractions and repulsions exhibited between wires or other conductors through which currents are passing. If two wires are paralled, they will attract each other when currents are passing the same way through them both, and will repel each other when the currents are opposite. If the wires are inclined to each other at any angle there is not only an attraction or repulsion, but a still more marked tendency to rotation, which is not satisfied till the wires have become parallel and the currents flow in the same direction through them both. When there are only two straight wires these forces are feeble and require delicate apparatus for their exhibition; but by employing coils of wire the forces are multiplied, and an instrument constructed on this principle called the electro-dynamometer has been much employed for the measurement of currents. The whole science of electro-dynamics is due to Ampère, who discovered its main facts, and reduced them by ingenious experiments, combined with very abstruse reasoning, to a single mathematical formula which includes them all.

Daily experience with the electric telegraph shows that electrical action is propagated with great rapidity. The time that intervenes between the sending of a signal from one station and its visible effect at another, depends on a variety of circumstances. The time is notably longer for underground or submarine wires than for wires suspended in the air on poles. When one end of a long submarine or subterranean telegraph wire is suddenly put in connection with a galvanic battery or other source of electricity, the current which flows out of the other end into the earth does not begin sharply but gradually, and takes a measurable time to attain its full strength. Hence an instrument which is delicate enough to show a very feeble current, will show the effect earlier than one which requires a strong current to move it. An instrument in which the moving parts are small and light has also an advantage over one in which they are large and heavy. Something, too, depends on the nature of the source of electricity employed. A source which acts with sudden violence, like the discharge of a Leyden-jar or an induction-coil, will make the effect appear earlier than a comparatively gentle source, such as an ordinary galvanic battery. Electrictiy has not a definite velocity like light or sound. It is rather comparable to waves on water, which travel with very various speeds according to their length and the depth of the water. The highest speed ever observed in the transmission of electric effects was that obtained by Wheatstone in his celebrated experiment with a rotating mirror. In this experiment a Leyden-jar was discharged through half a mile of wire with three interruptions in it, at each of which a spark was formed by the electricity leaping across. One interruption was in the middle, and the other two were at the ends, one end being close to the knob of the jar, and the other end close to its outer coating. The wire was so arranged that all three interruptions were near together; and by observing the reflections of the three sparks in a rotating mirror, he was able to discover that the middle spark occurred sensibly later than those at the two ends, these latter being simultaneous. The lagging of the middle spark behind the other two was regarded as the time that electricity took to travel through a quarter of a mile of wire, and the velocity thus found for electricity was 230,000 miles per second, a velocity greater than that of light, which is between 185,000 and 186,000 miles per second. Observations made in connection with the use of the electric telegraph for determining longitudes, have shown that the time which intervenes between the sending and receiving of a signal was about four-tenths of a second between Aden and Bombay, two-tenths of a second between Alexandria and Malta, two-tenths between Malta and Berlin, and about one-eighth of a second between Greenwich and Valentia.

If we endeavor to explain electrical phenomena by regarding electricity as a substance, we are met by two difficulties: one is that electricity adds nothing to the weight of a body; the other is that electrical phenomena are dual, as if there were two opposite kinds of electricity which destroy each other when they unite, Du Faye maintained the existence of two electrical fluids endowed with opposite qualities, and called them the vitreous and the resinous fluid. Franklin endeavored to account for the same phenomena by assuming the existence of a single electric fluid, and supposing an electrified body to be a body which possesses either more or less than the normal quantity of this fluid. If more, it was said to be positively, and if less, negatively electrified. Franklin's positive and negative corresponded with Du Faye's vitreous and resinous. Whenever electricity is generated the two opposite kinds are always produced, and produced in exactly equal quantity. Modern theories favor the idea that electricity is not a substance or a pair of substances, but a special kind of motion, and that the two opposite electricities are two opposite states of motion of the particles of a medium which is believed to pervade all bodies and all space: the same medium whose vibrations constitute light.

The employment of electricity commercially and industrially is daily increasing in importance. The electric

ELECTRIC LIGHT

telegraph has long been familiar, and the telephone is now almost equally so. Electric lighting is rapidly extending, and electric railways or tramways are increasing in number. The operations of electro-metallurgy are also of great importance.

The electric transmission of power is the transmission of power to a distance by electricity, effected by employing the source of power to drive a machine called a dynamo which generates an electric current. This current is conveyed by a copper conductor insulated from the earth to the distant station, where it passes through a machine called an electro-motor (see that article), one part of which (called the armature) is thereby made to revolve, and imparts its motion to the machinery which is to be driven.

This is the simplest arrangement, and is that which is commonly employed when the original currents are not of such high tension as to be dangerous to life in the case of accidental shocks. There is, however, a great waste of power in employing low-tension currents when the distance is great; hence it is becoming a common practice to employ high-tension currents for transmission through the long conductor which connects the two stations, and to convert these into low-tension currents before they reach the houses or workshops where they are to be used. This is done sometimes by employing the high-tension currents to drive a local dynamo which generates low-tension currents, sometimes by employing them to charge storage cells arranged in long series, and afterward connecting these cells in shorter series. When the original currents are alternating they are made to generate induced currents by means of an instrument called a transformer, which is similar in principle to an ordinary Ruhmkorff coil, with the important difference that the primary wire is long and thin, and the secondary wire short and thick. These methods of transmission and transformation are employed not only for giving out mechanical power, but also for electric lighting. In the gigantic installation which has been recently erected for supplying a large district in London with electricity sent from Deptford, the currents are alternating, and the conductors consist not of copper wires, but of two copper tubes one within the other, insulated from one another, the outer one being connected with the earth. It is believed that the time is not far distant when electricity will be generally laid on to houses in large towns as gas and water are now, and will be available both for electric lighting and for mechanical work such as driving lathes and sewing-machines, raising lifts, etc.

The phrase, "distribution of electricity," has been used during the last few years to denote the supplying of strong currents of electricity from central stations where they are generated, to houses, street lamps, etc., in their vicinity. The central station contains a few powerful dynamo machines, driven usually by steam-power. The positive and negative terminals of the dynamo are put in connection with the positive and negative main conductors which are to supply the district, and from these mains smaller conductors branch off to the houses or lamps. All these conductors are of copper, that metal when pure having seven times the conductivity of iron. Different methods are in use for keeping the supply of electricity steady in spite of the varying demands made upon it. In some systems of distribution, instead of the two main conductors being one positive and the other negative, each is positive and negative alternately, the reversals taking place some hundreds of times per second. The currents are then said to be alternating. When such reversals do not take place, the currents are said to be direct.

ELECTRIC LIGHT, a light obtained through heating a suitable body to incandescence by causing a current of electricity to pass through the body. The substance usually employed for this purpose in carbon, which has two recommendations: first, its power of bearing a very high temperature without melting; and secondly, its high emissive power, which is the source of most of the light in the flame of a candle, an oil lamp, or a jet of gas.

Fig. 1. Arc light carbons.

Until quite recent years the only kind of electric light in practical use was what is now called the arc light. The arc light is obtained by causing two sticks of carbon, one of them in connection with the positive and the other with the negative terminal of a battery or dynamo, to touch each other for an instant so as to complete the circuit, and then separating them and keeping them steadily at a small distance apart. Before the carbons have touched, the cold air between them prevents the current from passing, but as soon as they touch they become intensely heated, and if they are not separated too far the air between them is hot enough to serve as a conductor. The light is emitted partly by the ends of the carbons, especially of the positive carbon, and partly by the gaseous matter (containing also fine particles of solid carbon) which accupies the intervening space and forms the arc or streak of light joining the two carbon points. When the source of electricity is an alternating-current machine each carbon is alternately positive and negative several times in a second, and the two points behave alike. When the source is a direct-current machine or a galvanic battery the positive carbon wears away about twice as fast as the negative, and the positive carbon becomes hollow at the end, while the negative remains pointed. The hollow in the positive carbon is the brightest part of the whole arrangement; and when a beam of light is to be thrown in some definite direction, care should be taken that this hollow is exposed to view in that direction.

Fig. 1 contains a representation of the two carbons of the arc light as they appear when cold, the positive carbon being marked + and the negative −. Also a magnified representation such as can be obtained by throwing an image of the burning carbons on a screen by means of a lens.

To keep the carbons at the proper distance apart a special contrivance called a "regulator" is employed. There are many varieties of regulator, but they all depend on the principle that increase of distance between the carbons causes increase of resistance. They usually contain an electro-magnet through which either the whole or a portion of the current passes, and the variations in the strength of this magnet arising from change of resistance are taken advantage of to cause the motion, in one direction or the opposite, of a piece of iron which locks and unlocks the mechanism.

As regards the material of the carbon sticks, Sir Humphry Davy used pieces of wood-charcoal, and the substance deposited in the interior of gas retorts has sometimes been employed, but it is now usual to employ a mixture of powdered carbon (from gas retorts), lamp-black, syrup, and gum, with a very little water. The sticks are obtained by forcing this pasty mixture through a draw-plate; they are then baked, and after being again impregnated with syrup are heated to a high temperature.

Arc lights give the largest amount of light for a given amount of horse-power expended in driving the dynamo; but incandescent lights, which have been introduced by Edison, Swan, and other inventors of late years, possess several advantages. Fig. 2 represents Swan's incandescent lamp. a is a glass vessel of globular form exhausted very perfectly of air; b b is a fine elastic filament of carbon, prepared from parchment paper, and becoming incandescent when the current is sent through it. Its two ends are attached to two platinum wires which, where they pass out of the bulb, are hermetically sealed into its wall by

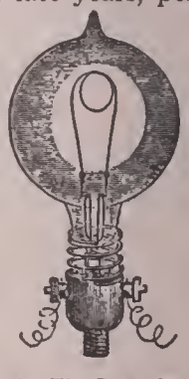


Fig. 2. The Swan lamp.

ELECTRIC MACHINES

fusion of the glass around the wires. These two wires are in connection with the two binding-screws c c when the lamp is upon the stand, where it is held in its place by the spiral wire d.

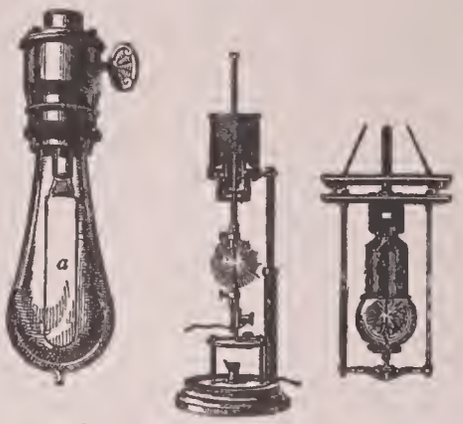
Owing to the absence of oxygen, there is no combustion in an incandescent lamp, and hence the carbon does not waste away. The want of means to obtain a sufficiently good vacuum was the chief cause which prevented the earlier introduction of such lamps. Sprengel's murcurial pump, with Crookes's improvements, has supplied this want. All the incandescent lamps agree in having a carbon filament suspended in vacuo, but they differ in the mode of preparation of the carbons and in other details.

The light of an incandescent lamp is extremely steady, affording a great contrast to the flickering which is never altogether absent from arc lights. Its temperature is lower, and hence its color is not blue or violet, like that of most arc lights, but slightly yellow, though whiter than gas. It is superior both to gas and to the arc light in giving off no products of combustion to vitiate the air of an apartment

The Jablochkoff light, which is represented in Fig. 3, occupies an intermediate place, but more nearly resembles the arc lamps. The two sticks of carbon (a a) arc side by side at the distance of $\frac{1}{4}$ inch or $\frac{1}{2}$ inch according to the power of the lamp, and this intervening space is occupied either with plaster of paris or china-clay (b). The lower ends of the carbon are inserted in copper or brass tubes (c c) separated by asbestos. The lamp is lighted by temporarily inserting a piece of carbon to connect the ends of the two sticks; and after a fair start has once been obtained, the top of the plaster of paris is hot enough to act as a conductor. Its incandescence contributes a portion of the light of the lamp, and it gradually burns away so as never to project quite so far as the carbons. Alternating currents are now always used with it, as the two carbons may then be exactly alike and will wear away equally.

Jablochkoff lamp.

The introduction of electric lights for commercial uses may be said to date from the lighting of the Avenue de l'Opéra at Paris by Jablochkoff lamps, a few years previous to the Paris Electrical Exhibition of 1881. The electric light, as previously known, was considered too dazzling for street purposes, but the Jablochkoff "candles," which even when naked are far less dazzling than "arc" lights, were concealed from direct view by opal globes, and instead of single points of dazzling brightness, presented an appearance like a row of full moons. The application of electricity to street lighting having thus been proved to be feasible, the attention of



Incandescent and arc lamps.

inventors was directed to the subject, and rapid improvements followed. The subsequent invention of "incandescent" or "glow" lamps rendered electricity applicable as an illuminant for domestic purposes. The electric lights now used for street lighting are sometimes Jablochkoff candles, but more frequently arc lights in opal globes. For the lighting of harbors and open spaces, naked arc lights are preferred, as they give more light in proportion to the expense than any other arrangement. For hotels, shops, dwelling-houses, and steamboats, incandescent lamps are almost exclusively employed. The currents necessary for producing the light are always obtained either directly or indirectly from dynamo or magneto machines driven by steam-engines or other prime movers. When we say "indirectly," we allude to the fact that galvanic batteries of the kind called storage batteries or accumulators are sometimes employed to give the currents; but these accumulators must first be charged by sending currents through them from dynamos, and can produce no current on their own account. For the methods of conveying currents from a central station to different parts of a district, see Electricity. For an explanation of the action of dynamos, see Magneto-electric Machines.

ELECTRIC MACHINES, any machine for producing powerful electrical

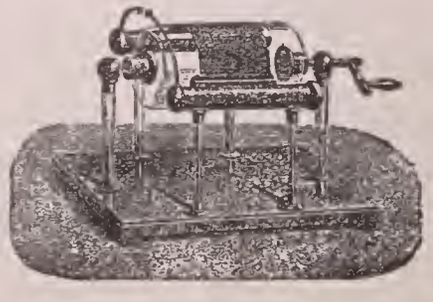


Fig. 1. Cylinder electric machine.

effects. The name is, however, seldom applied to machines depending on magneto-electric principles, and is practically confined to two classes of machines—those which act by friction, and those which act by electro-static induction. The former are called friction machines, and the latter influence machines. For many years the former were the only kind known, but they have now been almost superseded by the latter. In friction machines the electricity is generated by the friction of either a glass cylinder or a circular glass plate against cushions covered with an amalgam of zinc and tin. The positive electricity which is thus developed on the surface of the glass is given off to an insulated brass conductor furnished with teeth like those of a comb, the sharp points of which are nearly in contact with the glass. The negative electricity which is at the same time generated on the cushion must be provided with some means of escaping, or the action of the

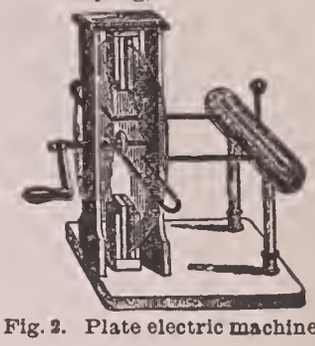


Fig. 2. Plate electric machine.

machine would soon stop. It is usually allowed to escape to the earth by a brass chain connected with the cushions; but in some machines a negative conductor connected with the cushions is insulated like the positive conductor by a glass support. Negative sparks can then be drawn from this conductor at the same time that positive sparks are drawn from the other. A cylinder machine having both a positive and a negative conductor is shown in Fig. 1, and a plate machine in Fig. 2.

An influence machine (that of Voss) is exhibited in Fig. 3. Of the two glass plates which it contains the larger is stationary, and has two patches of tin-

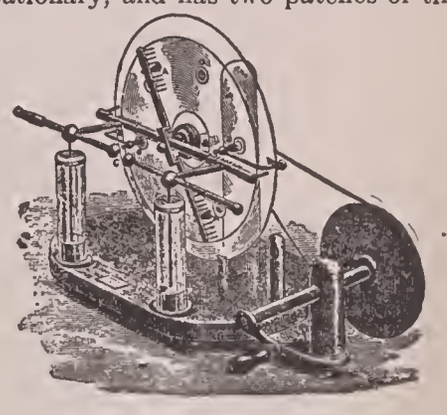


Fig. 3. Voss's influence machine.

foil on its back, one of which has a positive and the other a negative charge. One of them covers the left-hand and upper portion of the back, and the other the right-hand and lower portion. The revolving plate has six metallic studs like that seen at d set in it at equal distances. The sloping bar seen in front of it is of brass and carries two little brushes

a a of thin brass wire, against which the studs rub as they pass by, and this happens at the same moment for both brushes. When the studs have advanced about a quarter of a revolution, they come in contact with another pair of brushes b b which are in connection with the two patches of tinfoil, and serve to replenish their charges.

There are also two brass combs fixed opposite the two horizontal radii of the plate, one row collecting positive and the other negative electricity. They are in connection with the two knobs c which are seen in front of the machine, and a brilliant discharge of electricity takes place between these knobs. The first influence machine that came into extensive use was that of Holtz, and the latest (and probably the best) is that of Wimshurst, in which both the plates revolve, their directions of rotation being opposite. The machine of Holtz is started by holding a flat piece of vulcanite, which has been excited by friction, at the back of the fixed plate. The machines of Voss and Wimshurst, if kept dry, will usually work without such assistance, their action being such as to rapidly increase any casual charge possessed by the plates. For other kinds of machine by which electric shocks can be obtained, see Electro-medical Machines.

ELECTRIC RAILWAY, a railway in which the propulsion is effected by means of an electro-motor, that is, a machine one part of which can be made to revolve by sending a current through it. This revolving part, called the armature, is geared to the driving-wheels and forces them to revolve whenever the current passes. The current is supplied in some cases by storage cells carried in the car, these cells having themselves been first charged by a dynamo-machine. More usually the current is conveyed direct from a dynamo to the electro-motor, by means of a long conductor insulated from the ground, which is fixed either beside or between the rails, and is rubbed by a metallic brush attached to the car, this brush being in connection with the electro-motor. The current, after passing through the electro-motor, escapes to the axles of the driving-wheels, and so through the driving-wheels themselves to the rails, which need not be insulated. In many electric railways (or tramways) the conductor is an overhead wire from which the current is obtained to drive the cars. The first permanent electric railway was laid down at Berlin in 1881.

ELECTRIC TELEGRAPH. See Telegraph, Electric.

ELECTROCUTION, execution by electricity; that is, the killing of a man by an electric shock. This method of killing condemned criminals was adopted by New York in 1888 and by Ohio in 1896. It is supposed that the method is more humane than that of hanging. The condemned is led to a chair, an electrode is placed upon his bared leg, and enough current is sent into him to kill him. Many people think that electrocution is even more horrible than hanging. The courts, however, have decided that it is less so.

ELEC'TRODE, a term introduced by Faraday to denote the wires or other terminals by which electricity either enters or leaves a body which is undergoing electrolytic decomposition, in order to avoid an implied theory connected with the use of the older terms pole, positive pole, negative pole. He called the electrode at which the current enters the anode (ana, upward), and the electrode at which the current leaves the electrolyte the cathode (kata, downward). (See Electro-metallurgy.) The two latter terms have now been introduced in metallurgic practice; and the term electrode has become common in the extended sense of the way by which electricity enters or leaves an instrument. For instance, we speak of the electrodes of an electrometer or a galvanometer, or of a battery.

ELECTRO-DYNAMOMETER, an instrument used for the measurement of electric currents by means of the mechanical forces which they exert upon each other. It contains two coils of wire, one fixed and the other movable; the latter being either larger or smaller than the other so as to be able to pass either outside it or through it. Both coils are in vertical planes and have the same vertical diameter, round which the movable one can revolve so as to set its own plane at any angle with the plane of the other. The terminals of the movable coil dip in cups of mercury, one of which is in connection with one end of the fixed coil, and the other with one of the binding-screws of the instrument. The other binding-screw is in connection with the other end of the fixed coil. Hence when the two binding-screws are connected with a battery or other source of electricity, the current has to pass through both coils. Its effect is exhibited by a tendency in the movable coil to set its plane in coincidence with that of the fixed coil, and in such a manner that the current will circulate the same way round both coils. This tendency is resisted by mechanical means provided for the purpose—usually by the torsion of a wire from the end of which the movable coil hangs; and the measurement is usually made by applying torsion until the planes of the two coils are at right angles. The amount of torsion thus applied is proportional to the mutual force exerted by the two coils, and this is proportional to the square of the current, since when we double the current through one we also double the current through the other.

ELECTROL'YSIS [is] the chemical decomposition of certain compound bodies under the action of a current of electricity. The following are the main facts to be mentioned. When an electrolyte (as a body capable of electrolytic decomposition is called) is subjected to a current of electricity of sufficient intensity, it is broken up into two elements, which appear, one of them at one electrode and the other at the other electrode; thus, if two platinum plates connected with the first and last plates of a battery be plunged in a trough containing a solution of chloride of silver, the chlorine is given off at the plate by which positive electricity enters, that is, at the plate which is connected with the copper plate of the battery, and the silver is deposited at the plate connected with the zinc plate of the battery. The two elements are liberated at these places in quantities chemically equivalent. Thus for every 108 grammes of silver deposited at one side of the vessel 35·5 grammes of chlorine are given off at the other side. When a compound consisting of a metallic and a non-metallic part is decomposed, the non-metallic part is set free at the electrode at which the current enters and the metallic part at the opposite electrode. Hydrogen acts as a metal. Electrolysis takes place only when the electrolyte is in a liquid state, and involves a transfer of the materials of which the compound is composed from one part of the vessel to another.

The electrolytic action of the current is the same at all parts of the circuit. If the current is made to traverse several vessels, each containing the same substance, all in series (that is, the current that leaves the first entering the second, and so on), it will be found that in each of the cells precisely the same amount of decomposition goes on. There will be the same weight of silver deposited at one side, and the same weight of chlorine set free at the other.

The same quantity of electricity decomposes chemically equivalent quantities of different electrolytes. If we pass the current through a series of cells containing different electrolytes, for example, water, chloride of silver, sulphate of soda, and collect the products of decomposition, we find that the quantities of hydrogen, silver, and sodium set free are strictly proportional to the chemical equivalents of these bodies. Further, in the battery which gives rise to the electric current, if precautions are taken to avoid disturbance by local action on the plates, it is found that the action which goes on in each of its cells is chemically equivalent to that in each of the decomposing cells.

The quantity of the electrolyte decomposed in a given time is proportional to the strength of the current. Currents are often measured in practice by observing the weight of copper deposited in a given time from a solution of sulphate of copper.

ELECTROLYTE. See previous article

ELECTRO-MAGNET, a piece of iron temporarily converted into a magnet by means of a current of electricity sent through a wire which is coiled round it. The wire is usually covered with silk, cotton, gutta percha, or some other insulator, to prevent the current from leaping across, and compel it to travel through the whole length of the wire. The more pure and soft the iron is, the stronger will its magnetism be while it lasts, and the more completely will it disappear when the current stops. Steel is less affected than soft iron for the time, but remains permanently magnetized after the current ceases. Electro-magnets are usually much more powerful than other magnets of the same size. The iron which is magnetized by the current passing round it is called the core. It is frequently straight, the wire being wound upon it like thread upon a reel, but very frequently it has the shape of a U, or horse-shoe, the wire being coiled round the two ends and the bend of the U left uncovered.

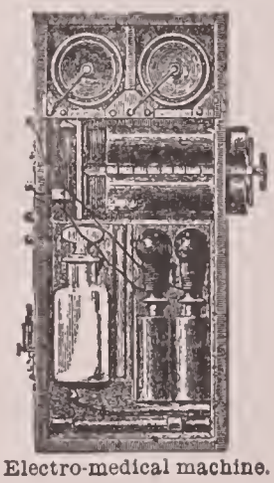
To prédict which end will be the north pole, the following rule may be employed: Let the core be a straight bar of iron held in front of you pointing left and right, then if the current ascends on the side next you, and descends on the further side, the north pole is to your left hand and the south pole to your right. If the straight bar is then bent into horse-shoe shape, its poles will not be changed. There is no necessity to inquire whether the wire forms a right-handed or a left-handed helix, this circumstance having no influence on the question of poles. Indeed, in most cases (just as in the case of thread on a reel) the helices are some right-handed and some left-handed.

An electro-magnet is said to be made when the current is sent through its coil, and unmade when the current is stopped. In some applications of electro-magnets it is necessary to make and unmake them in rapid succession. It is then preferable for the core to consist of a bundle of iron wires rather than of a solid bar.

ELECTRO-MAGNETISM, a term that in its broadest sense denotes the science which treats of the relations between magnetism and electricity. In a narrower sense a magnetic effect produced by electricity is said to be electro-magnetic, while an electrical effect produced by the agency of magnets is called magneto-electric. In the preceding article we have described one electro-magnetic effect—the making of an electro-magnet by means of a current. Another important electro-magnetic effect is the deflection of a magnetic needle by a current of electricity passing near it. The simplest experiment to illustrate this action is to take an ordinary mariner's compass, hold just above it a copper wire parallel to the needle of the compass, and then, while the wire is in this position, let its two ends be connected with the two poles of a galvanic battery. The needle will instantly turn away from its north-and-south position, and will remain deflected as long as the current continues to pass over it. If the current flows from south to north, the north end of the needle is turned to the west; and if the current is in the opposite direction, the needle turns the other way. This is the easiest test for determining the direction in which a current is flowing through a wire; and it is the basis of the construction of galvanometers, which are the instruments chiefly employed for the measurement of currents. The current tends to make the needle take a position at right angles to the direction of the current; but as the earth tends to make the needle point north and south, the position actually taken is between the two. The fact that a current deflects a needle was discovered by Œrsted of Copenhagen, and the general rule for the direction of the deflection was thrown into the following form by Ampère: Imagine the current to enter at your feet and come out at your head, then the north pole of a needle in front of you will be deflected to your left. This rule holds good whether the current is above the needle, below it, or in any other position. The rule may also be put in the following form: Imagine an ordinary screw placed so that the current is in its axis; the north pole of the needle will turn to the same side to which that part of the circumference which is next it turns when the screw advances in the direction of the current.

The leading fact of magneto-electricity is that when a magnet is moved in the neighborhood of a wire or other conductor, the motion causes a current of electricity in the conductor; and a similar effect occurs if the wire is moved while the magnet remains at rest. In the experiment, above described, of making a magnetic needle turn on its pivot by sending a current through a wire held above it, the motion of the needle produces for the time being a weakening of the current. If the needle were made by mechanical means to turn the contrary way, it would strengthen the current for the time being. If there were no original current, the turning of the needle to either side by mechanical means would produce a current in the wire. The current thus produced is always opposite in direction to that which would aid the motion.

ELECTRO-MEDICAL MACHINES, machines intended for giving shocks for medical purposes. They are of various kinds, but they all produce their effects by a rapid succession of either interruptions or reversals of an electric current. Such interruptions or reversals are always accompanied by the action called self-induction, especially when the original current flows through a coil of many convolutions, and still more if these convolutions encircle an iron core. Self-induction in such cases shows itself as a sudden and violent action, having the same sort of relation to a steady current that a blow has to a steady pressure. One form of electro-medical machine is shown above. At the top of the figure are shown two small galvanic cells, in which for greater portability materials of pasty consistency are used instead of liquids. The bottle shown below is for replenishing them. In the center of the figure are seen two cylindrical coils, through which the current from the two cells passes. They have cores of soft iron to strengthen their action, and they have also sliding covers of copper for mitigating their action. These are shown in the figure as pulled out a short distance, so as to uncover a small portion of the coils. The shocks become stronger as these covers are drawn further out. The action of the covers may be described as a muffling or cushioning of the sudden violence of self-induction. Some of the commonest forms of electro-medical machine are magneto-electric, their currents being produced by making a coil of copper wire rotate rapidly between the poles of a strong magnet. The employment of such a machine for administering shocks to patients is called faradisation, from Faraday, the discoverer of magneto-electricity.



Electro-medical machine.

ELECTRO-METAL'LURGY, the art of depositing metals from solutions of their salts upon metallic or other conducting surfaces by the agency of an electric current. Its operations may be classified under three heads: the making of facsimilies, the formation of permanent coatings, and the obtaining of a pure metal from an impure. In every instance the current enters the solution by a plate of the metal in question, which is immersed in it, and leaves the solution by the conducting surface on which the deposit is formed. The plate at which the current enters (called the anode) is gradually dissolved, and an equal quantity of the metal is at the same time deposited on the surface by which the current leaves the solution (called the cathode). The source employed for giving the current was formerly a galvanic battery, but is now more frequently a dynamo machine, in which the armature is constructed of much stouter wire than is used in dynamos intended for other purposes. Copper lends itself with special readiness to electrical deposition, and the solution employed for the purpose is usually a saturated solution of sulphate of copper; but if the surface to be coated is of iron, steel, or zinc, it is necessary to employ an alkaline solution, in which cyanide of potassium and carbonate of soda are usually the chief ingredients, a salt of copper being present in comparatively small quantity. For electro-gilding, a solution containing cyanide of potassium and cyanide of gold is employed; and for electro-plating, a solution of cyanide of potassium and cyanide of silver. It so happens that the impurities which usually occur in copper roughly smelted from the ore consist of substances which either cannot be dissolved in a solution of sulphate of copper, or cannot be deposited on a copper surface from such a solution. Hence when a plate of crude copper is used as the anode, pure copper is deposited on the cathode, and most of the impurities fall to the bottom of the vessel. Pure copper is now produced in enormons quantities by this method, purity being an essential requisite in copper wire for electrical purposes.

The most important instance of the position of a permanent coating is electro-plating. To ensure good adhesion it is necessary to remove every particle of grease and oxide from the surface (usually German silver) on which the silver is to be deposited. With this view the article to be plated, after being well scoured, is boiled in a strong lye of caustic potash or soda, and dipped in dilute acid, technically called pickle;

after which it is washed in distilled water, and then quickly dipped in a solution of nitrate of mercury until it appears white on the surface. Finally it is suspended in the silver solution, when it is immediately coated with a thin film of silver. This operation is called striking. After a few seconds it is taken out and well brushed, generally with bundles of brass wire attached to a lathe; it is then washed and replaced in the plating solution, where it is allowed to remain for a longer or shorter period according to the thickness of deposit required. An immersion of a few hours is generally sufficient. To ascertain the amount of metal deposited it is only necessary to weigh the articles from time to time. One and a quarter or one and a half ounce of silver to the square foot gives an excellent plate about the thickness of common writing-paper. In ordinary circumstances the coating of deposited silver is chalk-white, and has a dead or matted appearance, which is much esteemed for medals. Sometimes the operator is desirous of having his object bright, either entirely or partially. In this case the object is brushed over with old beer or dipped into a solution of soft soap, and is then submitted to the burnisher. Certain chemicals added to the solution will cause the original deposit to have a metallic luster

The production of copper facsimiles by the electric current is called electrotype, and is the oldest branch of electrometallurgy. One of its most important applications is the copying of type set up for printing, and of wood blocks for wood-cuts. A mould is first obtained in gutta percha or some similar material. This, being a non-conductor, is brushed over with plumbago in its interior, so as to give it a conducting surface to receive the deposit. After several hours the deposit is detached from the mould and backed by pouring in melted solder, the surface being first moistened with chloride of zinc to make the solder adhere. In the copying of steel engravings the mould is obtained by electro-deposition of copper on the steel, the surface of which must first be specially prepared to prevent adhesion; and a second electro-deposition of copper, on the mould thus obtained, gives the required copy, from which impressions can be printed.

ELECTROM'ETER, an instrument intended for accurate electro-statical measurements. Stated in precise technical language, its purpose is to measure the difference of potential between two conductors. Most of the electrometers in actual use are inventions of Sir William Thomson, who was the first to give accuracy to this branch of electrical measurement. His quadrant-electrometer is the instrument chiefly used, and its indications are usually given by means of a small movable mirror which reflects a spot of light from a lamp on to a paper scale. When the two conductors which are tested have the same potential the spot of light stands in the middle of the scale, and its movement to either side indicates the difference of their potentials. The instrument is sufficiently delicate to give a sensible displacement when the two conductors are the two plates of a single galvanic cell; and a displacement twice as great will be obtained by combining two such cells.

ELECTRO-MOTIVE FORCE, a phrase (commonly abbreviated into the three initial letters e.m.f.) which is of very frequent use in modern electrical literature, especially in connection with electric currents. The e.m.f in a wire through which a current is flowing may be compared to the difference of pressures in a long, narrow, horizontal pipe, through which water is flowing. As the difference of the pressure at the two ends of the pipe forces the water through in spite of frictional resistance, so the difference of the potentials at the two ends of the wire forces the current through in spite of the electrical resistance of the wire. This difference of potentials is another name for electro-motive force. Each cell of a battery is a source of e.m.f. and when the cells are connected in the usual way (technically called in series) their e.m.f.'s are added together, so that, for example, the e.m.f. of a battery of ten cells is ten times the e.m.f. of one cell. E.m.f. can also be produced in a wire by moving a magnet in its neighborhood, and this e.m.f. will be exactly proportional (other things being equal) to the velocity of the motion. The commercial unit of e.m.f. is the volt. Its magnitude may be inferred from the statement that the e.m.f. of a single cell is usually more than one volt, and less than 2½ volts. The highest e.m.f. permitted by the board of trade in wires which are liable to be touched by the public is about 200 volts. It is no unusual thing for a dynamo to give an e.m.f. of 1000 or 2000 volts. Currents produced by a source of high e.m.f. are often called currents of high tension. They are necessary when several arc lamps are to be supplied in series, and they are also necessary (on the score of economy) when power is to be transmitted by electricity to great distances.

ELECTRO-MOTORS, or **ELECTRO-MAGNETIC ENGINES,** are contrivances for making a current produce continuous rotatory motion, the force producing the motion being sufficient to overcome a considerable amount of mechanical resistance, and so do useful work. Until quite recent years this object was effected by the alternate making and unmaking of electro-magnets, which attracted pieces of iron provided for the purpose, and caused them to move in the directions required for producing continuous rotation. In modern electro-motors the action is greatly intensified by employing, instead of the above-mentioned pieces of iron, electro-magnets whose poles are alternately attracted and repelled by those of the fixed electro-magnets. In order to produce these alternate attractions and repulsions the currents in the moving electro-magnets are continually reversed, while the currents in the fixed magnets are always in the same direction. The revolving electro-magnet or group of electro-magnets is called the armature. It revolves with great rapidity, and its movement is transmitted by a belt or otherwise to the machinery which is to be driven. The construction of an electro-motor is almost precisely similar to that of a direct-current dynamo. Indeed the same machines have often been used interchangeably for both purposes. See Electric Railway, Electricity.

ELECTROPH'ORUS, an electrical instrument consisting of two plates, the lower of vulcanite or shellac, with tin-foil or other metal at the bottom, and the upper of brass, with a glass handle The operator begins by applying friction

Electrophorus.

with a catskin or flannel to the upper surface of the lower plate, which thus acquires a negative charge. The upper plate is then placed upon it and pressed closely down. In this process the upper plate, being in connection with the earth through the body of the operator, acquires a positive charge by induction; and if the upper plate be now lifted off by its glass handle, a good spark can be obtained from it. It may then be pressed down again, removed again, and another spark obtained, and so on, time after time. If the insulation is thoroughly good, hundreds of sparks can be drawn in this way without the necessity of renewing the charge on the surface of the lower plate. It might have been expected that the upper plate would require a coating of insulating varnish to prevent it from touching the lower one; but experience shows that this precaution is unnecessary. A smooth plate of metal does not easily receive electricity from an insulating substance with which it is brought in contact. The electrophorus is often so constructed that when the two plates are in contact, the upper plate is in conducting communication with the metal base of the lower plate. This arrangement saves time, as it is then unnccessary to touch the upper plate with the hand.

ELECTROPLATE. See Electro-metallurgy.

ELEC'TROSCOPE, any apparatus for showing the presence of electricity without giving quantitative measurements. One form consists of two stiff straws loosely tied together at the top, so that

Gold leaf electroscope.

they are free to open out at the bottom whenever they repel each other. If they are placed in conducting communication with an electrified body they will open out. A more sensitive instrument is the

gold-leaf electroscope, which is represented in the adjoining figure. Here the two gold leaves are shown diverging under the influence of an electrified body held over the instrument. The gold leaves are attached to the lower end of a short rod of brass, whose upper end carries the brass knob which forms the top of the instrument. These metal parts are supported by the glass shade which insulates them from the earth, and the upper part of which is represented in the figure as coated with varnish, but this is not essential. The two gold leaves originally hang down parallel and nearly touching each other. When an electrified body is slowly brought down over the knob from a good height above it, the unlike electricity is attracted to the knob, and the like electricity is repelled into the gold leaves, which, in consequence of being thus electrified, repel each other. The two little brass columns standing up from the base are in connection with the earth, and their presence increases the divergence of the leaves. As soon as the electrified body above is removed, the leaves come together again. If, however, while the leaves are standing apart under the influence of the body overhead, the knob is touched with the finger the leaves will instantly come together. It will then be found that either lowering or raising the influencing body causes them to open out again; and if the influencing body is removed they will open out to the same width at which they stood just before the knob was touched. The leaves and knob have now a charge opposite to that of the influencing body, and the electroscope can now be used to show whether the charge of a second influencing body is positive or negative. If the second body has the same kind of electricity as the first, it will diminish the repulsion; if it has the opposite kind, it will increase the repulsion.

ELEC'TROTYPE, that branch of electro-metallurgy which deals with the production of facsimiles. See Electro-metallurgy.

EL'EGY, a mournful and plaintive poem or funeral song, or any serious poem of a melancholy contemplative kind. In classic poetry what is known as elegiac verse is composed of couplets consisting of alternate hexameter and pentameter lines.

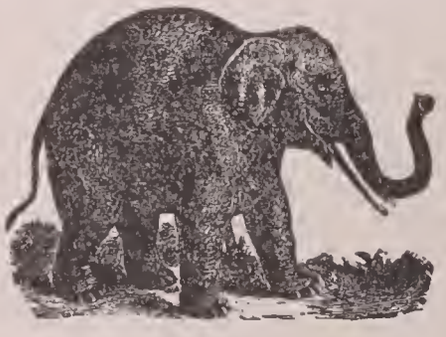
ELEMEN'TAL SPIRITS, according to a belief common in the middle ages, spirits proper to and partaking of the our so-called elements, viz. salamanders or fire spirits, sylphs or aerial spirits, gnomes or earth spirits, and undines or water spirits.

ELEMENTARY EDUCATION. See Education.

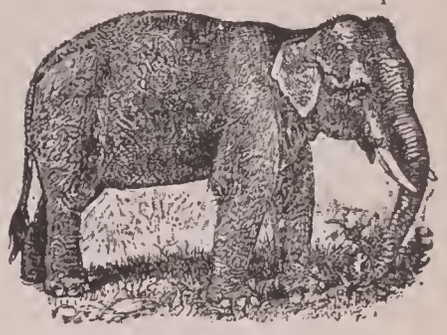
EL'EMENTS, the simplest constituent principles or parts of anything; in a special sense, the ultimate indecomposible constituents of any kind of matter. In ancient philosophies the term was applied to fire, air, earth, and water. The mediæval chemists, however, absorbed in the study of metals and mineral substances, supposed that the metals consisted of an elemental sulphur and an elemental mercury mixed together more or less perfectly and in different proportions. To these were subsequently added salt and some others, so that about the middle of the 17th century the first principles amounted to five, divided into two classes: the active, consisting of mercury or spirit, sulphur or oil, and salt; and the passive, consisting of water or phlegm, and earth or the terrestrial part. The names remained, not so much as denoting substances or ultimate principles as gradually coming to denote functions; the first great modification being the expansion of the idea of elemental sulphur into phlogiston by Stahl, as the result of which the adherents of the phlogistic theory applied the term to phlogiston, to the gases then discovered, the mineral, vegetable, and animal acids, the alkalies, earths, and metallic calces, oil, alcohol, and water. The substances considered as simple naturally changed with the change of theory introduced by Lavoisier, who considered as elements, oxygen, nitrogen, hydrogen, sulphur, phosphorus, and carbon, the metals and the earths, and, as Boyle had already suggested, practically defined an element as a body not yet decomposed, the definition now commonly adopted. For list of known elements see Chemistry.

EL'EPHANT, the popular name of a genus or sub-family of five-toed proboscidian mammals, usually regarded as comprehending two species, the Asiatic and the African. From a difference in the teeth, however, the African species is sometimes treated as a distinct genus, and some authors divide the Asiatic elephants into several species, such as the Indian elephant, the Ceylon elephant and the Sumatra elephant. The so-called white elephants are merely albinos. The African elephant is distinguished from the Asiatic species by its greater height, its larger ears, its less elevated head and bulging or convex forehead, the closer approximation of the roots of the tusks, and the greater density of the bone. It has also only three external hoofs on the hind-feet, while the Asiatic has four. All elephants are remarkable for their large, heavy, short bodies supported on columnar limbs, a very short neck, a skull with lofty crown and short face-bones, with the exception of the premaxillaries, which are enlarged to form tusk-sockets. To compensate for the short neck, they have the long proboscis, often 4 or 5 feet in length, produced by the union and development of the nose and upper lip. It is made up of muscular and membraneous tissue, the only cartilages being the valves at the entrance of the nares. The trunk is of great strength and sensibility, and serves alike for respiration, smell, taste, suction, touch, and prehension. The tusks, which are enormously developed upper incisor teeth, are not visible in young animals, but in a state of maturity they project, in some instances 7 or 8 feet. The largest on record (possibly that of an extinct species) weighed 350 lbs. Elephants sometimes attain the height of 15 feet, but their general height is about 9 or 10. Their weight ranges from 4000 to 9000 lbs. The female is gravid twenty months, and seldom produces more than one at a birth: this, when first born, is about 3 feet high, and continues to grow till it is sixteen or eighteen years of age. It is said they live to the age of 100 years and upward. They feed on vegetables, the young shoots of trees, grain,

African elephant.

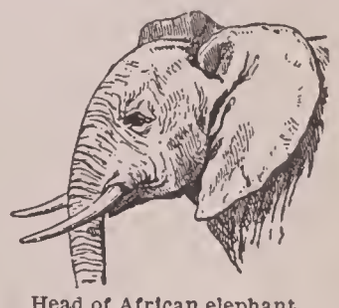


Asiatic elephant.



Indian elephant.

Head of Indian elephant.



Head of African elephant.

and fruit. They are polygamous, associating in herds of a considerable size under the guidance of a single leader. The domesticated elephant requires much care, and a plentiful supply of food, being liable to many ailments. The daily consumption of a working elephant is, 2 cwts. of green food, about half a bushel of grain, and about 40 gallons of water. Their enormous strength, docility, and sagacity make them of great value in the East for road-making, building and transport. They are used on occasions of pomp and show, being often richly caparisoned, and bearing on their back a howdah containing one or more riders, besides the mahout or driver sitting on the animal's neck. Tiger-shooting is often practiced from an elephant's back. The fossil remains of the genus Elephas indicate the former existence of at least fourteen species; and a still larger number of species belong to the allied genus Mastodon.

ELEPHANTI'ASIS, a disease chiefly occurring in tropical climates, characterized by a peculiar overgrowth of the skin and subjacent textures, and attacking especially the legs, which become enlarged and elephantine. It appears to arise from repeated inflammation of the skin and a concurrent obstruction of the veins and lymphatic glands of the inflamed part. The disease occasionally affects the scrotum, enlarging it to enormous dimensions. In general it is attended with little pain, and the health may remain otherwise unaffected for many years. In the early stages wet bandaging or ligature of the main artery has been found serviceable, but amputation may be necessary.

ELEPHANT-SEAL, the proboscis seal, or sea-elephant, the largest of the seal family. There are probably two species, one found only on the coast of California and Western Mexico, the other found in Patagonia, Kerguelen Island, Heard's Island, and other parts of the southern seas. They vary in length from 12 to 30 feet, and in girth at the chest from 8 to 18 feet. The proboscis of the male is about 15 inches long when the creature is at rest, but elongates under excitement. The females have no proboscis, and are considerably smaller than the male. Both species are becoming rare from their continual slaughter.

ELEPHANT'S-EAR, a name sometimes given to plants of the genus Begonia.

ELEVATION, in architecture, a geometrical delineation of the front or any face of a building in which all the parts are drawn according to scale, and not shown as they would appear in perspective.—In astronomy, it is the height of a celestial object above the horizon.

ELEVATION OF THE HOST, in the ritual of the Mass, is the lifting up of the elements immediately after consecration, to be worshiped by the people. It was introduced into the Latin Church in the 11th century.

EL'EVATOR, a mechanical contrivance consisting of a series of boxes or buckets attached to a belt traveling round two drums, one above and one below, for hoisting grain, meal, etc., into a mill or storehouse from a ship's hold, etc. In the U. States large buildings containing such contrivances, and in which grain is stored, receive the same name.—(2) An apparatus for raising or lowering persons or goods to or from different levels in warehouses, hotels, etc., consisting usually of a cage or movable platform worked by hydraulic, steam, or electric power.

ELF. See Fairy.

ELGIN, a royal and parliament burgh of Scotland, capital of Elgin county, finely situated on the Lossie, about 5 miles from its influx into the Moray Firth, 70 miles n.w. of Aberdeen. Pop. 8260.—The county of Elgin, also called Morayshire, is a maritime county, bounded by the Moray Firth, Banffshire, Inverness-shire, and Nairnshire; area, 340,000 acres. Pop. 44,808.

ELGIN, a town on the Fox river in Kane co., Ill., noted for its important manufacturing and agricultural industries. It is charmingly situated on a number of pretty hills and is the centre of one of the prettiest districts in America. Here is situated the Elgin watch works the products of which have a world-wide reputation. Elgin is also the center of one of the finest dairy farming districts in the world. The Illinois State Hospital for the Insane is the largest public institution. Pop. 25,000.

ELGIN, James Bruce, Eighth Earl of, and twelfth Earl of Kincardine, Governor-general of India, born in 1811. He died in 1863.

EL HASA, a fertile district of Eastern Arabia, on the Persian Gulf. It produces dates, wheat, millet, rice, etc. Pop. estimated at 160,000.

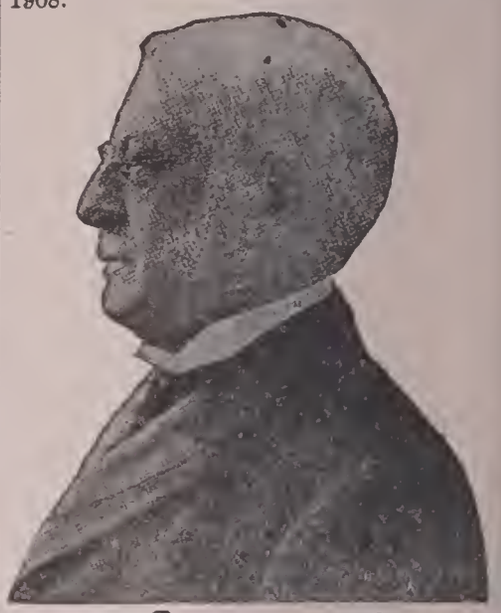
ELI, one of the Hebrew judges, the predecessor of Samuel. He was high-priest and judge for forty years, but was less successful as head of his own household. His two sons having been slain and the ark taken in battle by the Philistines, the news proved so severe a shock that he fell and broke his neck, at the age of ninety-eight. Little is really known of the history of Eli, since he is only shown to us in the weakness of old age, unable to control his sons Hophni and Phinehas, whose wickedness disgusted and alienated the people.

ELI'AS, the New Testament form of Elijah.

ELIAS, Mount St. See Saint Elias, Mount.

ELI'JAH, the most distinguished of the prophets of Irsael, flourished in the 9th century B.C., during the reigns of Ahab and Ahaziah, and until the beginning of the reign of Jehoram, his special function being to denounce vengeance on the kings of Israel for their apostasy. He incurred the anger of Jezebel, wife of Ahab, for slaying the prophets of Baal, but escaped to Horeb, afterward returning to Samaria to denounce Ahab for the murder of Naboth. Elijah at length ascended to heaven in a chariot of fire, Elisha, his successor, being witness. See 1 Kings xvii. to xxi. and 2 Kings i. and ii.

ELIOT, Charles William, a noted American educator, born in Boston in 1834. He was educated at Harvard and held several chairs in the university until 1869, when he became its president. Under his administration the university had its greatest growth. He remodeled the curriculum, devised the elective system of studies and soon became the acknowledged authority in America on higher education. He has published several text-books and a number of essays and addresses. He resigned the presidency of Harvard in 1908.



Charles W. Eliot

EL'IOT, George, the assumed literary name of Mary Ann, or, as she preferred to write the name in later years, Marian Evans, English novelist. Born at Griff, near Nuneaton, on 22d November, 1820. She received at Coventry an excellent education, comprising the classical and modern languages, and shortly after her twenty-first year became a convert to rationalism. It was not, however, until January, 1857, that she came prominentnently into public notice, with the first of a series of tales entitled Scenes from Clerical Life. The series came to an end in November, 1857, and in the following year the publication of Adam Bede placed her in the first rank of writers of fiction. It was succeeded by the Mill on the Floss (1860), Silas Marner (1861), Romola (1863), Felix Holt (1866), Middlemarch (1872), and Daniel Deronda (1876). In addition to those prose works she published three volumes of poems, The Spanish Gypsy (1868), Agatha (1869), and the Legend of Jubal (1874). Her last work published during her life was the series of essays entitled The Impressions of Theophrastus Such (1879), but a volume of mixed essays was issued posthumously. For many years she was happily associated both in life and work with George Henry Lewes, though a legal union was impossible during the lifetime of Mrs. Lewes. In May, 1880, after Mr. Lewes' death, she married Mr. John Cross, but did not survive the marriage many months, dying rather suddenly at Chelsea on the 22d December of that year.

ELI'SHA, a Hebrew prophet, the disciple and successor of Elijah. Many miracles of prediction and cure, and eve

of raising the dead, are ascribed to him, but his figure is less original and heroic than that of his master. He held the office of prophet for fully sixty-five years from the reign of Ahab to that of Joash (latter half of 9th century B.C.).

ELIX'IR, a word of Arabic origin, applied by the alchemists to a number of solutions employed in attempting the transmutation of metals into gold, and also to a potion, the elixir vitæ, or elixir of life, supposed to confer immortality. It is still used for various popular remedies, for the most part composed of various aromatic and stimulative substances held in solution by alcohol.

ELIZABETH, a city in New Jersey, 14 miles s.w. from New York, with which it has ample communication by railway and steamer. It is a favorite residence of New York business men. The Singer Sewing Machine Co. has a large factory here, and there are also foundries, oil-cloth factories, etc. Pop. 1909, 70,000.

ELIZABETH, Queen of England, daughter of Henry VIII. and of Anne Boleyn, was born at Greenwich September 7th, 1533, and almost immediately declared heiress to the crown. On the accession of Edward VI. Elizabeth was committed to the care of the

Queen Elizabeth.

queen-dowager Catherine. The first great object of her reign was the settlement of religion, to effect which a parliament was called on 25th January, and dissolved on the 8th May, its object having been accomplished. The nation was prepared for a return to the reformed faith, and the parliament was at the bidding of the court. The ecclesiastical system devised in her father's reign was re-established, the royal supremacy asserted, and the revised prayer-book enforced by the act of uniformity. While, however, the formal establishment of the reformed religion was easily completed, the security and defense of the settlement was the main object of the policy and the chief source of all the struggles and contentions of her reign. With the unfortunate Mary, Queen of Scots, were connected many of the political events of Elizabeth's reign. On her accession the country was at war with France. Peace was easily concluded (1559); but the assumption by Francis and Mary of the royal arms and titles of England led to an immediate interference on the part of Elizabeth in the affairs of Scotland. The detention of Mary in England (1568–87), whither she fled to the protection of Elizabeth, led to a series of conspiracies, beginning with that under the Earls of Northumberland and Westmoreland, and ending with the plot of Babington, which finally determined Elizabeth to make away with her captive. The execution of Queen Mary (1587), though it has stained her name to posterity, tended to confirm her power among her contemporaries, and caused Philip of Spain to send the Armada against England (see Armada). The war with Spain dragged on till the close of Elizabeth's long reign. During her reign the splendor of her government at home and abroad was sustained by such men as Burleigh, Bacon, Walsingham, and Throgmorton; but she had personal favorites of less merit who were often more brilliantly rewarded. Chief of these were Dudley, whom she created Earl of Leicester, and whom she was disposed to marry, and Essex, whose violent passions brought about his ruin. He was beheaded in 1601, but Elizabeth never forgave herself his death. Her own health soon after gave way, and she died on 24th March, 1603, naming James VI. of Scotland as her successor.

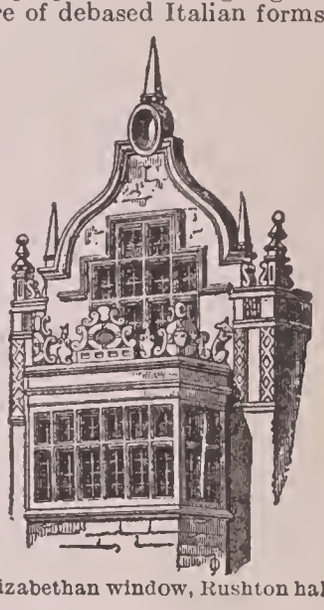
ELIZ'ABETHAN ARCHITECTURE, a style of architecture which prevailed in England during the reigns of Elizabeth and James I. It succeeded to the Tudor style, properly so called, with which it is sometimes confounded. The Elizabethan is a mixture of inferior Gothic and debased Italian, producing a singular heterogeneousness in detail, with, however, wonderful picturesqueness in general effect, and domestic accommodation more in accordance with the wants of an advancing civilization than was afforded by the styles which preceded it. The chief characteristics of Elizabethan architecture are: windows

Elizabethan architecture—Hargrave hall, England.

of great size both in the plane of the wall and deeply embayed, ceilings very richly decorated in relief, galleries of great length, very tall and highly-decorated chimneys, as well as a profuse use of ornamental strap-work in the parapets, window-heads, etc. The Elizabethan style is the last stage of the Tudor or Perpendicular, and from its corresponding in point of period with the Renaissance of the Continent has sometimes been called the English Renaissance. The epithet Jacobean has sometimes

Drawing-room of Bramhall hall, Cheshire. Time of Elizabeth.

been given to the very latest stage of the Elizabethan, differing from the Elizabethan proper in showing a greater admixture of debased Italian forms. The



Elizabethan window, Rushton hall.

princely houses which arose during the reign of Elizabeth are numerous, and many even yet remain to attest the splendor of the time. Of these may be mentioned Burghley House, Hardwick Hall, and Bramhall Hall.

ELIZABETH FARNESE (fâr-nā'zā), Queen of Spain, daughter of Edward II., prince of Parma, born 1692. On becoming the second wife of Philip V. she surprised those who had counseled the marriage by assuming the practical headship of the kingdom, and her ambition and that of her minister Alberoni disturbed the whole of Europe. The "termagant tenacious woman," as Carlyle called her, died in 1766.

ELIZABETH OF VALOIS, or **ISABELLA,** Queen of Spain, was born in 1545, daughter of Henry II. of France and Catherine de Medici. She was destined by the Treaty of Cateau-Cambrésis to be the wife of the infante, Don Carlos, but his father, Philip II., being left a widower, became fascinated and married her himself. She died in 1568.

ELIZABETH PETROWNA, Empress of Russia, daughter of Peter the Great and Catherine, born in 1709 or 1710, ascended the throne on 7th Dec. 1741, as the result of a conspiracy, in which

Ivan VI., a minor, was deposed. Elizabeth is said to have rivalled her mother in beauty, and to have surpassed her in her love of pleasure, and her government was largely conducted by favorites. She was a patron of literature, founded the University of Moscow, and corresponded with Voltaire. She died in 1762.

ELIZABETH STUART, Queen of Bohemia, daughter of James I. of England and VI. of Scotland, born in Falkland Palace, Fifeshire, 1596. Her marriage with the Palatine Frederick was celebrated at Whitehall in 1613. Her husband, then at the head of the Protestant interest in Germany, accepted in 1619 the crown of Bohemia offered to him by the revolted Protestants of that country; but after his defeat by the imperialists at the battle of Prague in 1620 he and his wife were obliged to flee, first to Breslau and Berlin, and then to the Hague. She returned to England at the Restoration with her nephew Charles II., and died at Leicester House, London on 13th Feb., 1662.

ELK, Moose, or Moose Deer, the largest of the deer family, a native of northern Europe, Asia, and America. The American form (to which the name moose is usually given) is sometimes separated from the European, but most naturalists find no specific difference between them. The elk or moose has a

Elk.

short compact body, standing about 6 feet in height at the shoulders, a thick neck, large clumsy head, and horns which flatten out almost from the base into a broad palmate form with numerous snags. In color the elk is grayish brown, the limbs, sides of head, and coarse mane being, however, of a lighter hue. Their flesh resembles beef rather than venison. For the most they are inoffensive, and so exceedingly wary that they are approached only with difficulty. In America the Indians and half-breeds are the most skilful moose-hunters. The moose has a wide range in Canada, extending from the Aretic Ocean and British Columbia to New Brunswick and Nova Scotia; and it is found also in Maine. It feeds largely on the shoots of trees or shrubs, such as the willow and maple, and on bark, etc. In Sweden its destruction is illegal, and in Norway, there are many restrictions.

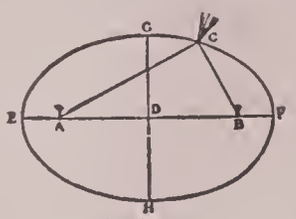
ELK'HART, a town of Indiana, on the Elkhart River, with railroad works, paper-mills, etc. Pop. 13,140.

ELKINS, Stephen Benton, an American politician, born in Ohio in 1841. He studied law, began practice in Missouri, removed to New Mexico in 1864 and was territorial delegate from 1873 to 1877. He removed to West Virginia, was secretary of war in President Harrison's cabinet and in 1894 was elected U. States senator from West Virginia.

ELKS, Benevolent and Protective Order of, a fraternal association organized in 1868 and consisting chiefly of theatrical people. It has lodges in numerous cities of the U. States and is very active in contributing to all kinds of charities through its great "benefit" performances. The membership is upward of 150,000.

ELLIOTT, Maxine, an American actress, born in Maine. She made her first important appearance in 1890 in The Middleman and subsequently joined Daly's company going to London, where she played in Shakespearean parts. In 1898 she was married to N. C. Goodwin, with whom she has appeared in various plays with great success.

ELLIPSE', a figure in geometry ranking next in importance to the circle, and produced when any cone is cut by a plane which passes through it not parallel to nor cutting the base. Kepler



Ellipse.

discovered that the paths described by the planets in their revolutions round the sun are ellipses, the sun being placed in one of the foci. To describe an ellipse:—At a given distance on the surface on which the ellipse is to be described fix two pins, a and b, and pass a looped string round them. Keep the string stretched by a pencil, c, and move the pencil round, keeping the string at the same tension, then the ellipse e g f h will be described; f and g are the foci, d the center, e f the major axis, and g h the minor axis, d a or d b is the eccentricity of the ellipse. A line drawn from any point in the curve perpendicularly to the axis is an ordinate to the axis. Any straight line drawn through the center and terminated both ways by the curve is called a diameter.

ELLIP'SIS, in grammar, the omission of one or more words, which may be easily supplied by the connection.

ELLIPTIC'ITY of the earth, the deviation of the form of the earth from that of a sphere. See Earth, Degree.

ELLSWORTH, Ephraim Elmer, an American soldier-hero, born in New York in 1837, died in 1861. In April, 1861 he organized a Zouave regiment in Chicago, went to the front, and was the first man killed in the north. On May 24 he was shot dead at Alexandria by an inn-keeper from whom he had just torn a confederate flag.

ELLSWORTH, Oliver, an American jurist, born in Connecticut in 1745, died in 1807. He took a leading part in the continental congress and in the early Connecticut legislature and from 1796 to 1800 was chief justice of the U. States Supreme Court.

ELM, a genus of trees, consisting of thirteen species, all natives of the northern temperate zone. They have bisexual flowers with a campanulate calyx, as many stamens as there are divisions in the limb of the calyx, and two styles.

Flowering branch and foliage of English elm with flower and fruit on larger scale.

The American or white elm is abundant in the Western States, attaining its loftiest stature between lat. 42° and 46°; here it reaches the height of 100 feet, with a trunk 4 or 5 feet in diameter, rising sometimes 60 or 70 feet before it separates into a few primary limbs. Its wood is not much esteemed. The red or slippery elm is found over a great extent of country in Canada, Missouri, and as far south as lat. 31°; it attains the height of 50 or 60 feet, with a trunk 15 or 20 inches in diameter; the wood is of better quality than that of the white elm. The leaves and bark yield an abundant mucilage. The wahoo, inhabiting from lat. 37° to Florida, Louisiana, and Arkansas, is a small tree, 30 feet high. The branches are furnished on two opposite sides with wings of cork 2 or 3 lines wide; the wood is fine-grained and heavy.

ELMI'RA, a town in New York, on the Chemung River; with a college for women, the state reformatory, fine courthouse, etc. Its industrial establishments comprise rolling-mill, blast-furnace, foundries, machine-works, etc. Pop. 1909, 42,000.

ELMO'S FIRE, St., a meteoric appearance often seen playing about the masts and rigging of ships. If two flames are visible (Castor and Pollux) the sailors consider it a good omen; if only one (Helena), they regard it as a bad one.

ELOCUTION, the art by which, in delivering a discourse before an audience, the speaker is enabled, with greatest east and certainty, to render it effective and impressive. The value of an elocutionary training is very great, as well in sparing the voice as in overcoming natural defects in delivery, and in cultivating and developing the natural taste.

ELO'HIM, one of the Hebrew names for God, of frequent occurrence in the Bible. Elohim is used in speaking both of the true God and of false gods, while Jehovah is confined to the true God. The plural form of Elohim has caused a good deal of controversy, some considering it as containing an allusion to the doctrine of the trinity, others regarding it as the plural of excellence, others holding it as establishing the fact

of a primitive polytheism. The Elohistic passages in the Pentateuch, or, in other words, the passages in which the Almighty is always spoken of as Elohim, are supposed to have been written at an earlier period than those in which he is spoken of as Jehovah. The Elohistic passages are simpler and more primitive in character than the Jehovistic; thus Gen. i. 27 is Elohistic; Gen. ii. 21–24 is Jehovistic.

ELONGATION, Angle of, the angular distance of a planet from the sun, as it appears to the eye of a spectator on the earth.

ELOPEMENT, in law, the desertion of her husband by a woman and her cohabitation with another man. The term does not legally apply to unmarried persons who flee or abscond for the purpose of becoming married, although it is generally used in that way. The consequent of the act today is to free the husband from all responsibility for his wife's debts or her support.

EL PASO, the capital of El Paso co., Texas, a railway center and port of entry; situated on the Rio Grande. Near it the river passes through a mountain-gap called El Paso del Norte (North Pass), which is the chief thoroughfare between Mexico and New Mexico. On the opposite bank of the Rio Grande, in Chihuahua, Mexico, is Ciudad Jaurez, formerly called Paso del Norte, a village important as the starting-point of the Mexican Central Railroad, and having a custom-house, through which a large amount of goods pass in transit between the U. States and Mexico. Pop. 18,575.

ELPHINSTONE, Hon. Mountstuart, Indian administrator, born in Scotland in 1778. He joined the Bengal civil

Mountstuart Elphinstone.

service in 1795, was ambassador to the Afghan court in 1808, was resident at the court of Poonah from 1810 to 1817, and was British commissioner to that province from 1817 to 1819, when he became governor of Bombay, During a government of seven years he established a code of laws, lightened taxes, and paid great attention to schools and public institutions. He resigned in 1827. A college established by the natives was called after him Elphinstone College. He was offered the governor-generalship of India in 1835, and afterward that of Canada, both of which he declined. He died in 1859.

ELSSLER, Fanny, an Austrian dancer born in 1810, died in 1884. In 1841 she visited the U. States and was received with much enthusiasm by lovers of the ballet. Her sister Therese also became proficient as a dancer. She was created Baroness von Barnim by the King of Prussia.

ELVES. See Elf.

ELWELL, Frank Edwin, an American sculptor, born in Massachusetts in 1858. He has made a number of noted figures and groups including "Awakening of Egypt," "Death of Strength," "Intelligence," and several monumental groups.

ELWOOD, a town in Madison co., Ind., on the Pitts., Cin., Ch. and St. L. and Erie railways; 45 miles n.n.e. of Indianapolis. It is a shipping-point for grain and stock. Pop. 15,160.

ELY, Isle of, a portion of the county of Cambridge, separated by the Ouse from the rest of the county, and forming itself a sort of county. It is about 28 miles long by 25 miles broad; area, 239,259 acres. Pop. 63,861.

ELYRIA, the capital of Lorain co., Ohio, beautifully situated at the confluence of the eastern and western branches of Black river; 7 miles s. of Lake Erie and 25 miles w. of Cleveland. Sandstone is one of the chief exports. Pop. 10,391.

ELYS'IUM, Elysian Fields, among the Greeks and Romans the regions inhabited by the blessed after death. They are placed by Homer at the extremities of the earth, by Plato at the antipodes, and by others in the Fortunate Islands (the Canaries). They were at last transferred to the interior of the earth, which is Virgil's notion.

EMANCIPATION, Liberation from slavery or subjection of some kind. See Catholic Emancipation, Slavery.

EMANCIPATION, PROCLAMATION OF, the paper issued by President Lincoln, Jan. 1, 1863, declaring the negro slaves free. It was issued as a war measure. The proclamation read as follows:

BY THE PRESIDENT OF THE UNITED STATES OF AMERICA.

A PROCLAMATION.

Whereas, on the 22d day of September, in the year of our Lord one thousand eight hundred sixty-two, a proclamation was issued by the President of the United States, containing among other things, the following, to wit:

"That on the 1st day of January, in the year of our Lord one thousand eight hundred sixty-three, all persons held as slaves within any state, or designated part of a state, the people whereof shall then be in rebellion against the United States, shall be then, thenceforward, and forever free; and the executive government of the United States, including the military and naval authority thereof, will recognize and maintain the freedom of such persons, and will do no act or acts to repress such persons, or any of them, in any efforts they may make for their actual freedom.

"That the executive will, on the first day of January, aforesaid, by proclamation, designate the states and parts of states, if any, in which the people thereof respectively shall then be in rebellion against the United States, and the fact that any state, or the people thereof, shall on that day be in good faith represented in the Congress of the United States by members chosen thereto at elections wherein a majority of the qualified voters of such state shall have participated, shall, in the absence of strong countervailing testimony, be deemed conclusive evidence that such state and the people thereof are not then in rebellion against the United States."

Now, therefore, I, Abraham Lincoln, President of the United States, by virtue of the power in me vested as commander-in-chief of the army and navy of the United States and as a fit and necessary war measure for repressing said rebellion, do, on this first day of January, in the year of our Lord one thousand eight hundred sixty-three, and in accordance with my purpose so to do, publicly proclaimed for the full period of 100 days from the day first above mentioned, order and designate as the states and parts of states wherein the people thereof, respectively, are this day in rebellion against the United States, the following, to wit:

Arkansas, Texas, Louisiana, (except the parishes of Saint Bernard, Plaquemines, Jefferson, Saint John, Saint Charles, Saint James, Ascension, Assumption, Terre Bonne, Lafourche, Saint Mary, Saint Martin, and Orleans, including the city of New Orleans), Mississippi, Alabama, Florida, Georgia, South Carolina, North Carolina, and Virginia (except the forty-eight counties designated as West Virginia, and also the counties of Berkeley, Accomac, Northampton, Elizabeth City, York, Princess Ann, and Norfolk, including the cities of Norfolk and Portsmouth), and which excepted parts are, for the present, left precisely as if this proclamation were not issued.

And by virtue of the power and for the purpose aforesaid, I do order and declare that all persons held as slaves within said designated states and parts of states are, and henceforward shall be free; and and that the executive government of the United States, including the military and naval authorities thereof, will recognize and maintain the freedom of said persons.

And I hereby enjoin upon the people so declared to be free, to abstain from all violence, unless in necessary self-defense; and I recommend to them that in all cases, when allowed, they labor faithfully for reasonable wages.

And I further declare and make known that such persons of suitable condition will be received into the armed service of the United States to garrison forts, positions, stations, and other places, and to man vessels of all sorts in said service.

And upon this act, sincerely believed to be an act of justice, warranted by the constitution, upon military necessity, I invoke the considerate judgment of mankind and the gracious favor of Almighty God.

In witness whereof, I have hereunto set my hand, and caused the seal of the United States to be affixed.

Done at the city of Washington, this first day of January, in the year of our

Lord one thousand eight hundred sixty-three, and of the independence of the United States of America the eighty-seventh.

[L.S.] By the President:

ABRAHAM LINCOLN.

WILLIAM H. SEWARD, Secretary of State.

EMAN'UEL THE GREAT, King of Portugal, ascended the throne in 1495. During his reign were performed the voyages of discovery of Vasco da Gama, of Cabral, of Americus Vespucius, and the heroic exploits of Albuquerque, by whose exertions a passage was found to the East Indies, the Portuguese dominion in Goa was established, the Brazils, the Moluccas, etc., were discovered. The commerce of Portugal, under Emanuel was more prosperous than at any former period. The treasures of America flowed into Lisbon, and the reign of Emanuel was justly called "the golden age of Portugal." He died in 1521, aged fifty-two.

EMBALMING (em-bäm'ing), the process of filling and surrounding with aromatic and antiseptic substances any bodies, particularly corpses, in order to preserve them from corruption. The ancient Egyptians employed the art on a great scale, and other peoples, for example the Assyrians and Persians, followed them, but by no means equalled them in it. The ancient Peruvians appear to have injected and washed the corpses with the fluid that flows from imperfectly burned wood, which would of course contain pyroligneous acid, creosote, and other antiseptics. Pliny alludes to the use of a similar fluid by the Egyptians for embalming. In later times bodies have been preserved a long time by embalming, especially when they have remained at a low and uniform temperature, and have been protected from the air. The body of Edward I. was buried in Westminster Abbey in 1307, and in 1770 was found entire. Canute died in 1036; his body was found very fresh in 1776 in Winchester Cathedral. The bodies of William the Conqueror and of Matilda, his wife, were found entire at Caen in the 16th century. Of the various modern artificial means of preserving bodies, impregnation with corrosive sublimate appears to be one of the most effective, next to immersion in spirits. An injection of sulphate of zinc into the blood-vessels is said to be very effective.

EMBANK'MENT, a mound of earth, etc., thrown up either for the purpose of forming a roadway at a level different from that of the natural surface of the ground, or for keeping a large body of water within certain limits.

EMBAR'GO, in commerce, an arrest on ships or merchandise by public authority; or a prohibition of state, commonly on foreign ships, in time of war, to prevent their going out of or coming into port. A breach of embargo, under knowledge of the insured, discharges the underwriters of all liability.

EM'BASSY, in its strict sense, signifies a mission presided over by an ambassador, as distinguished from a legation or mission intrusted to an envoy. An ambassador, as the representative of the person of his sovereign, can demand a private audience of the sovereign to whom he is accredited, while an envoy must communicate with the minister for foreign affairs.

EMBER-DAYS, in the Anglican and Roman Catholic Churches, fast-days occurring at the times in the year appointed for ordination. As now observed they are the Wednesday, Friday and Saturday after the first Sunday in Lent, after the feast of Pentecost or Whitsunday, after the festival of the Holy Cross (14th Sept.), and after the festival of St. Lucia (13th Dec.). The weeks in which these days fall are called Ember-weeks.

EMBER-GOOSE, a bird, known also as the great northern diver and loon. See Divers.

EMBERIZ'IDÆ, a family of small birds belonging to the order Insessōres and tribe Conirostres, typical genus Emberīza. It includes the buntings, the

Texas sparrow.

snow-flake, the yellow-hammer, and reed sparrow. The ortolan belongs to this family. By some naturalists they are classified as a sub-family of the finches. The Texas sparrow or green-finch is a common species in the lower Rio Grande valley.

EMBEZ'ZLEMENT is the appropriation, by a clerk or servant, to himself, of money or property put into his hands in trust. In English law it is a felony punishable by penal servitude for not more than fourteen years, or by imprisonment; and in the case of a male under the age of sixteen, by whipping in addition to the imprisonment.

EM'BLEM, specifically a picture representing one thing to the eye and another to the understanding. The most common emblems are such as a balance, which represents justice; a crown, an emblem of royalty; the serpent, of cunning; etc.

EM'BOLISM, the blocking up of a blood-vessel by a clot of blood that comes from some distance, till it reaches a vessel too small to permit its onward progress, often the cause of sudden paralysis and death, or of gangrene and pyæmia.

EMBOS'SING, the art of producing raised figures upon plane surfaces, such as on leather and cloth for bookbinding, etc.; on paper for envelopes, etc.; on wood or bronze, in architecture or sculpture.

EMBROI'DERY, figured work in gold, or silver, or silk thread, wrought by the needle, upon cloths, stuffs, or muslins. The art was common in the East in very ancient times. The Jews appear to have acquired it from the Egyptians; Homer makes frequent allusion to it; and Phrygia was celebrated for its embroidery, which was in great demand at Rome. Embroidery is commonly divided into two classes; white embroidery applied to dress and furniture, in which the French and the Swiss excel; and embroidery in silk, gold, and silver, chiefly in demand for ecclesiastical vestments, etc. The Chinese, Hindus, Persians, and Turks excel in work of this kind.

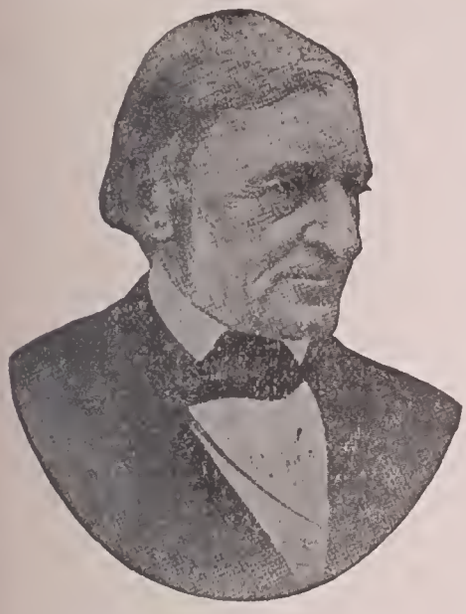
EM'BRYO, (1) in zoology, the earliest and rudimentary form in which any young animal appears; it may be the first rudiments of the animal in the womb, before the several members are distinctly formed, after which it is called the fetus. (2) In plants the embryo is the rudimentary organism contained in the seed.

EMBRYOL'OGY, the branch of biology comprising the history of animals from the first appearance of organization in the egg or ovum (the embryo stage) up to the attainment of the perfect form. The importance of the study partly depends upon the fact that the history of animals thus traced reveals the existence of structures which disappear at a later period, or become obscured by arrest of their development, or by union with other parts, and permits us to follow the steps by which complex organs arise by the combination of simpler parts. Thus points of affinity are detected between species and orders whose adult aspect is very unlike.

EM'ERALD, a well-known gem of pure green color, somewhat harder than quartz; it is a silicate of aluminium and the rare element glucinum or beryllium, which was detected in it by Vauquelin after it had been discovered by the same chemist in the beryl. Its color is due to the presence of chromium. Its natural form is either rounded or that of a short six-sided prism. It is one of the softest of the precious stones, but is not acted on by acids. Emeralds of large size and at the same time free from flaws are rare;

EM'ERSON, Ralph Waldo, an American poet and prose writer, born at Boston in 1803. He graduated at Harvard in 1821, for five years taught in a school, and in 1829 became minister to a Unitarian church in Boston, but in 1832 resigned his charge. He spent greater part of 1833 in Europe, and on his return began his career as a lecturer on various subjects, in which capacity he acted for a long series of years. In 1835 he took up his permanent residence at Concord, Mass., and in 1836 published a small volume called Nature. He was one of the original editors of the Dial, a transcendental magazine begun in 1840. Two volumes of his essays were published in 1841 and 1844, and his poems in 1846. His miscellaneous addresses had been published in England in 1844, and on visiting Great Britain in 1847 he was welcomed by a large circle of admirers. In 1850 he published Representative Men; in 1856, English Traits in 1860, The Conduct of Life; in 1869 May Day and Other Poems, and Society and Solitude; in 1871, Parnassus, a collection of poems; in 1876, Letters and

Social Aims. He died April 27, 1882. Emerson showed certain similarities with Carlyle, of whom he was a friend and correspondent. Their correspondence appeared in 1883. He was one of the most original and influential writers that the U. States have produced.



R. Waldo Emerson

EM'ERY, an impure variety of corundum, of blackish or bluish-gray color, chiefly found in shapeless masses and mixed with other minerals. It contains about 82 per cent of alumina and a small portion of iron; is very hard; is infusible, and is not attacked by acids. The best emery is brought from the Levant, chiefly from Cape Emeri in Naxos. It also occurs in Spain, and in a few iron-mines in Great Britain. It is employed in cutting and polishing precious stones; in smoothing the surface of the finer kinds of lenses preparatory to their being polished; in the polishing of marble; by cutlers, locksmiths, glaziers, and other artisans. For all these purposes it is pulverized in large iron mortars or in steel mills, and the powder, which is rough and sharp, is carefully washed and sifted into eight or ten different degrees of fineness. Emery-paper and emery-cloth are made by laying a thin coat of glue upon the fabric, and dusting the emery from a sieve of the required size.

EMET'IC, any substance administered to induce vomiting. Emetics are most commonly administered to remove poisonous or indigestible substances from the stomach, or to clear the air-passages of obstructive morbid material in cases of bronchitis, croup, etc. Ipecacuanha and sulphate of zinc are frequently given for these purposes, or, as a readily obtainable substitute, mustard stirred into water. They should, however, always be administered with caution, or serious injury to the system may result.

EMEU, EMU (ē'mū), a large cursorial bird, formerly dispersed over the whole Australian continent, but now almost extirpated in many districts. It is alied to the cassowary, but is distinguished by the absence of a "helmet" on the top of the head. It nearly equals the ostrich in bulk, being thicker in the body, though its legs and neck are shorter. Its feet are three-toed (the ostrich has two toes), and its feathers, which are double, are of a dull sooty-brown color, those about the neck and

Emu.

head being of a hairy texture. The wings are small and useless for flight, but the bird can run with great speed, and emeu coursing as a sport is said to surpass that of the hare. The flesh of the young emeu is by some considered a delicacy. The emeu is a bird of the plain, the cassowary of the forest. It is easily tamed, and may be kept out of doors in temperate climates. It feeds on vegetable matter, fruits, roots, etc.

EMIGRATION. See Immigration.

EMIGRES (ā-mi-grās), a name given more particularly to those persons who left France at the commencement of the French revolution.

EMINENT DOMAIN, the right of a state or sovereign, to appropriate property for the use of the state, or public use. In the U. States the right imbues in the general government and in all of the several states, either by right of their sovereignty or by vestment from the constitution. The right, however, has its restrictions. Property cannot be taken by eminent domain except "by due process of law," and just compensation given to the person or persons from whom the property has been taken. The usual procedure is to condemn the property and then to pay to the owner the compensation fixed by a court or other body, this compensation being full value for present or future interests in the property.

EM'MET, Robert, an Irish patriot, born at Cork in 1780. He was expelled from Trinity College, Dublin, in 1798, on the ground of exciting disaffection and rebellion, and having become an object of suspicion to the government, quitted Ireland. He returned there on the repeal of the suspension of the habeas corpus act, and became a member of the Society of United Irishmen for the establishment of the independence of Ireland. In July, 1803, he was the leader in the rebellion in which Lord Kilwarden and others perished. He was arrested a few days afterward, tried, and executed. His fate excited special interest from his attachment to Miss Sarah Curran, daughter of the celebrated barrister. Emmet's speech before his execution is one of the most stirring and eloquent masterpieces of the world's oratory. His remains are buried in Trinity churchyard, New York.

EMMETT, Daniel Decatur, an American writer of songs and singer, born in Ohio in 1815, died in 1902. He was the author of the song "Dixie" which, carried south during the civil war by Union soldiers, became the war song of the south. Among his other famous songs were "Old Dan Tucker" and "Walk Along John."

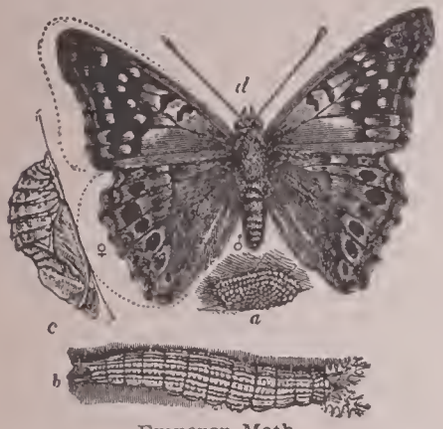
EMOTION, a term variously used by psychologists; sometimes as one of the divisions of feeling the other being sensation; sometimes as opposed to feeling when the latter is identified with sensation, and sometimes as distinct from both sensation and feeling, when the last term is rigidly confined to the sense of pleasure or pain. In any one of these uses, however, emotions are distinguished from sensations in that sensations are primary forms of consciousness arising by external excitation, are comparatively simple. and immediately presentative phenomena, and are definite in character and capable of localization; while emotions are secondary or derived forms of consciousness, are complex and representative, and are vague and diffused. Sensations are said to be "peripherally initiated," while emotions are centrally initiated. When, in addition to its being distinguished from sensation, it is also distinguished from feeling, emotion is applied to the whole physical condition accompanying the sense of pleasure or pain (feeling). The muscles of the body and the organic functions of the system are often considerably influenced by emotion, which naturally seeks an outward expression unless held in check by what Darwin has called serviceable associated habits.

EM'PEROR, the title of the highest rank of sovereigns. The word imperātor from imperāre, to command, in its most general sense signified the commander of an army. After the overthrow of the Roman republic imperator became the title of the rulers or emperors, and indicated their supreme power. Charlemagne was crowned, by Leo III., as "Carolus Augustus, the God-sent pious and great emperor of Rome." Napoleon I. adopted the old idea of an empire as a general union of states under the protection, or at least political preponderance, of one powerful state; and he was followed in this by his nephew, Napoleon III. In 1806 the first German Empire, 1000 years old, became extinct, and the German Emperor, Francis II., adopted the title of Francis I., emperor of Austria. In December, 1870, the second German Empire was formed, King William of Prussia having accepted the imperial office and title offered him at Versailles while engaged in the siege of Paris. Britain is considered as an empire, the crown as imperial, and the paliament is styled the Imperial Parliament of Great Britain and Ireland; but the sovereign has not the imperial title in reference to the home dominions, though the king bears the title of Emperor of India.

EMPEROR MOTH, a British moth of the silk-worm family. The color is grayish-brown, with a faint purple tinge. The wings are about 3 inches in expanse, and in the center of each is a large eye-like spot. The larva is of a

green color, with a black band on each segment.

EM'PHASIS, in rhetoric, a special stress or force given to some syllable, word, or words in speaking, in order to impress the hearers in some desired manner, thus differing from accent, the position of which is fixed.



Emperor Moth.
a, eggs; *b*, larva, dorsal view; *c*, pupa, lateral view; *d*, male butterfly, with partial outline of female. (All natural size.)

EMPIRE, the dominions of an emperor.—Empire State, a name given to New York State, New York being called the Empire City.

EMPIR'IC, in medical history an appellation assumed by a sect of physicians who contended that observation and experience alone were the foundation of the art of medicine. An empiric, in modern medicine, is a physician who has had no regular professional education, but who relies on what is frequently a very crude experience.

EMPLOYERS' LIABILITY, the liability of persons employing others for the injuries such employes sustain in the service of their employers. The liability, however, is limited. The servant entering the employ of another person is assumed to take the ordinary risks of the service or business, including the risks from the negligence of fellow employes. The employer is liable for injuries employes sustain when the injury is due to negligence on the part of the employer himself.

EMPLOYMENT BUREAU, an agency which secures positions for unemployed persons and secures helpers for those in want of help. In several foreign countries the government engages in this kind of intermediation. Also labor unions operate employment agencies. Several states of the U. States have tried the experiment and certain cities have employment bureaus in operation with some success. The great mass of this business is, however, undertaken by private enterprises which receive fees from both sides. Employment agencies, owing to fraudulent practices by disreputable concerns, are now generally regulated by law.

EMPORIA, city and railway center; capital of Lyon co., Kan., on the A., T. and S. F. and the M., K. and T. R. Rs; 6 miles above the junction of the Neosho and Cottonwood rivers, in a fine agricultural and stock-raising region. Pop. 10,120.

EMPO'RIUM, a center of extensive commerce, a trading town or city.

EMS, a beautiful watering-place in the Prussian province of Hesse-Nassau, on the river Lahn, not far from its confluence with the Rhine. Its mineral waters are warm—from 70° to 118° Fahr., contain large quantities of carbonic acid gas, and are used in chronic catarrhs, pulmonary complaints, diseases of the stomach, gout, and some diseases of the urinary vessels. There are about 8,000 visitors each season. Pop. 6,943.

EMU. See Emeu.

EMUL'SION, a medical preparation, consisting of an oily or resinous substance made to combine with water by some substance that itself has the property of combining with both, such as gum arabic, the yolk of eggs, almonds, etc.

ENAM'EL, a vitreous glaze of various colors fused to the surface of gold, silver, copper, and other substances. The art of enameling, which is of great antiquity, was practiced by the Assyrians and by the Egyptians, from whom it may have passed into Greece, and thence into Rome and its provinces, including Great Britain, where various Roman antiquities with enameled ornamentation has been discovered. The basis of all kinds of enamel is a perfectly transparent and fusible glass, which is rendered either semi-transparent or opaque by the admixture of metallic oxides. White enamels are composed by melting the oxide of tin with glass, and adding a small quantity of manganese or phosphate of calcium to increase the brilliancy of the color. The addition of the oxide of lead, or antimony, or oxide of silver, produces a yellow enamel. Reds are formed by copper, and by an intermixture of the oxides of gold and iron. Greens, violets, and blues are formed from the oxides of copper, cobalt, and iron. In the middle of the 18th century enameling was largely applied to the decoration of snuff-boxes, tea-canisters, candlesticks, and other small articles. Of late years it has been extensively applied to the coating of iron vessels for domestic purposes, the protection of the insides of baths, cisterns, and boilers, and the like. Enameling in colors upon iron is now common, iron plates being thus treated by means of various mixtures, and words and designs of various kinds being permanently fixed upon them by stencilling, for advertising, sign-boards, etc.

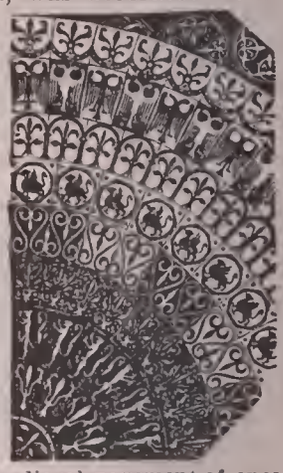
ENCAMPMENT. See Camp.

ENCAR'PUS, in architecture, a sculptured ornament in imitation of a garland

Encarpus—From Palazzo Niccolini, Rome.

of fruits, leaves, or flowers, suspended between two points. The garland is of greatest size in the middle, and diminishes gradually to the points of suspension, from which the ends generally hang down. The encarpus is sometimes composed of an imitation of drapery similarly disposed, and sometimes of an assemblage of musical instruments, implements of war or of the chase.

ENCAUSTIC TILES, ornamental paving-tiles of baked pottery, much used during the middle ages in the pavements of churches and othes ecclesiastical edifices. The encaustic tile, strictly so-called, was decorated with patterns



Part of medieval pavement of encaustic tiles —Church of St. Pierre-sur-Dive, Normandy.

formed by different colored clays inlaid in the tile and fired with it. The art appears to have originated in the latter part of the 12th century, to have attained its highest perfection during the 13th, and to have sunk into disuse in the 15th. During the whole of this period it was principally carried on in England and Normandy. After a long lapse the art was revived in England in 1830 by Wright, a Shelton potter. In modern manufacture two methods are employed, the "plastic" and the "semi-dry" or "dust" method. The first is, in all essentials, that used in the middle ages, except, perhaps, in the perfection of modern molding appliances; the second consists in ramming pulverized clay with a minimum of moisture into metal dies, the subsequent firing of tiles thus consolidated being attended with less risk from shrinkage.

ENCEINTE (ȧn-sant'), in fortification, the continuous line of works which forms the main enclosure of a town or fortress. The term is also applied to the area within this line.

ENCKE (en'ke), Johann Franz, German astronomer, born at Hamburg in 1791. He calculated the orbit of the comet observed by Mechain, Miss Herschel, and Pons, predicted its return, and detected a gradual acceleration of movement, ascribed by him to the presence of a resisting medium. The comet is now known as Encke's comet. The fame of his works The Distance of the Sun, Transit of Venus of 1769 led to his appointment as director of the Berlin Observatory (1825), a position which he held till his death in 1865.

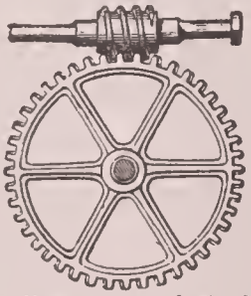
ENCYCLOPÆDIA, CYCLOPÆDIA, or **CYCLOPEDIA,** a systematic view of the whole extent of human knowledge or of particular departments of it, with the subjects arranged generally in alphabetic order. Varro and Pliny the elder, among the Romans, attempted works

of an encyclopædic nature, the latter in his well-known Historia Naturalis, or Natural History. Other ancient encyclopedic works were those of Stobæus and Suidas, and especially of Marcianus Capella. In the 13th century a work on a regular plan was compiled by the Dominican Vincent of Beauvais (d. 1264), in which was exhibited the whole sum of the knowledge of the middle ages. His work was entitled Speculum Historiale, Naturale, Doctrinale, to which an anonymous author added, some years later, a Speculum Morale. Roger Bacon's Opus Majus also belonged to the encyclopedic class. An exceedingly popular work was the De Proprietatibus Rerum of Bartholomeus de Glanvilla, an English Franciscan friar, which maintained its reputation from 1360 to the middle of the 16th century. In the 17th century various encyclopedic works were compiled, such as the Latin one of Johann Heinrich Alsted (in 7 vols., Herborn, 1620). In 1674 appeared the first edition of Moreri's Le Grand Dictionnaire Historique; in 1677 Johann Jacob Hoffmann published at Basel his Lexicon Universale; and in 1697 appeared Bayle's famous Dictionnaire Historique et Critique, which is still of great value. The first English alphabetical encyclopædia was the Lexicon Technicum, published in 1704. Among the chief English works of this kind are: 1. Ephriam Chambers's Cyclopædia, or a Universal Dictionary of Arts and Sciences, published in 1728 in 2 vols. folio. 2. The Encyclopædia Britannica, published in Edinburgh, in nine editions—the first in 1788, the last in 1875–88 (24 vols. 4to, with supplement, 11 vols., 1902–03). 3. Rees' Cyclopædia, 39 vols. 4to, illustrated, 1802–20. 4. Edinburgh Encyclopædia, 1810–30, 18 vols. 4to, conducted by Sir David (then Dr.) Brewster. 5. Encyclopædia Metropolitana, London, 29 vols. 4to, and containing some valuable complete treatises. 6. The London Encyclopædia, by Thomas Curtis, 22 vols. 4to; London, 1829. 7. The Penny Cyclopædia, in 28 vols. small folio, 1833–43; since recast under the name of the English Cyclopædia. 8. Chambers's Encyclopædia, in 10 vols. large 8vo, 1860–68; new edition in 1888–92. 9. The Popular Encyclopædia, in 7 vols. large 8vo, 1833–38; now issued in 14 vols. The chief American encyclopædias are the Encyclopædia Americana, in 13 vols., 1829–33; the New American Cyclopædia, in 16 vols., 1858–63 and 1881, Johnson's Universal Cyclopedia, 4 vols., 1874–77, and 8 vols., 1895, and the International Encyclopædia, 17 vols. 1904, 20 vols. 1906. Of the French cyclopædias the most famous is the great Dictionnaire Encyclopédique, by Diderot and D'Alembert (see next article); the Encyclopédie Méthodique, ou par Ordre des Matiéres, Paris, 1781–1832, in 201 vols. 4to, of which 47 are plates; the Encyclopédie Moderne, 1824–32, 26 vols.; the Encyclopédie des Gens du Monde, 1835–44, 22 vols.; the Dictionnaire de la Conversation et de la Lecture 1851–58; the excellent Grande Encyclopédie, 31 vols.; and the large and valuable Grand Dictionnaire Universel du XIX Siècle, edited by Larousse, 16 vols. folio (with supplementary vols.). Numerous works of this kind have been published in Germany, the most popular being the Conversations-Lexikon of Brockhaus, now in its fourteenth edition; Meyer's Konversations-Lexicon, in its fifth edition; Pierer's Konversations-Lexikon, in its seventh edition; and that issued by Spamer, now in its second edition. The most comprehensive is the Allgemeine Encyklopädie, originally edited by Professors Ersch and Gruber, begun in 1818, and not yet completed.

ENCYCLOPEDIE (äṇ-sik-lo-pā-dē), the French, the most important work of the 18th century after the works of Voltaire and Rousseau, originated in a French translation of Ephriam Chambers's Cylcopædia. Diderot was appointed to edit it, and enlisted the ablest men of the time as contributors. Diderot himself was a prolific contributor on a wide variety of topics.

ENDEM'IC, a name commonly applied to diseases which attack the inhabitants of a particular district or country, and have their origin in some local cause, as the physical character of the place where they prevail, or in the employment, habits, and mode of living of the people. Diseases which are endemic in one country may also appear in others, and become epidemic under influences resembling those which are the cause of the endemic in the former place.

ENDLESS SCREW, a mechanical contrivance, consisting of a screw, the thread of which gears into a wheel with skew teeth, the obliquity corresponding to the



Endless screw and wheel.

angle of pitch of the screw. It is generally employed as a means of producing slow motion in the adjustments of machines, rather than as transmitter of any great amount of power.

ENDOG'AMY, a custom among some savage peoples of marrying only within their own tribe: opposite to exogamy.

ENDOGENOUS PLANTS (en-doj'-e-nus), or **ENDOGENS,** one of the large primary classes into which the vegetable kingdom is divided, so named in consequence of the new woody bundles being developed in the interior of the stem, in which there is no distinction of pith and bark. In transverse section these bundles appear scattered through the cellular matter, being more compact toward the circumference. The other organs of the plants are also characteristic. The leaves are generally parallel-veined, the flowers usually with three organs in each whorl, the seed has an embryo with one cotyledon, and the radicle issues from a sheath and is never developed into a tap-root in germination. To this class belong palms, grasses, rushes, lilies. etc. Endogens increase in thickness only to a limited extent; hence they are not injured by twining plants as exogens are.

ENE'MA, any liquid or gaseous form of medicine for injection into the rectum. It is most commonly administered to induce peristaltic action of the bowels, but it is often the most desirable means of conveying into the system nourishment or stimulants.

EN'ERGY, in physics, the power that a body or system possesses of doing work. A body may possess energy in one of two forms, viz. as kinetic energy, that is the energy due to motion, and potential energy, that is energy due to what may be called a position of advantage. Thus a moving mass, a bullet for example, can do work in virtue of its motion, and the name kinetic energy is given to energy of this kind. Under this name is also included energy belonging to molecular motion, to electricity in motion, to heat and light, and to actual chemical action. Again, as examples of potential energy we may take the case of a mass raised up to a position in which it is capable of doing work by falling—the weight of a clock for instance; but the term also includes the energy due to electrical separation, to absorb heat, and to chemical separation, as in gunpowder, which is ready to do work by means of its explosion. From the investigations of Joule and others into the nature and phenomena of heat and the discovery of the equivalence of a definite quantity of mechanical energy to a definite quantity of heat, the grand principle of the conservation of energy was established. This asserts that the total amount of energy in the universe, or in any limited system which does not receive energy from without, or part with it to external matter, is invariable. If energy of any form seems to disappear in such a case it reappears in some other form. Thus, mechanical energy may be converted into heat. Heat again may be converted into the energy of electricity in motion, or into the potential energy of chemical separation. And electrical energy, whether potential or kinetic, and the energy of chemical separation, are also convertible into heat. (See also Correlation of Physical Forces.) Connected with this principle is another which states that no known natural process is exactly reversible, and that if we transform mechanical energy into heat, for example, we never can pass back and obtain from the heat produced precisely the amount of mechanical energy with which we commenced. Whatever attempt is made to transform and retransform energy by an imperfect process and no known process is perfect, part of the energy is necessarily transformed into heat, and is dissipated so as to be incapable of further useful transformation. It therefore follows, that as energy is in a constant state of transformation, there is a constant process of degradation of energy going on, a process by which energy constantly approaches the unavailable form of uniformly diffused heat; and this will go on till the whole of the energy of the universe has taken this final form.

EN'GINE, a mechanical contrivance in which one or other of the natural

forces is utilized for the performance of work of some kind; often distinctively a steam-engine.

ENGINEER CORPS, the name applied to the body of engineers of the U. States navy, established by the act of congress which was approved Aug. 31, 1842. The engineers came into the navy with the adoption of steam power, and their importance has steadily increased since that time. In 1866 the first cadet engineers were admitted to the naval academy and the number grew yearly until, in 1899, the engineer corps, as an acknowledged separate body was lost in the general plan of officers, thus putting an end to the ill feeling which had existed in the navy between the engineers and the line officers.

ENGINEERING INSTRUMENTS, instruments used by eivil engineers in the various work attendant upon surveying. They are used generally for measuring levels or horizontal lines, measuring distances, measuring angles, and for other work. Distance is measured by the chain, the surveyor's compass is used for measuring direction, the level is used for determining horizontal lines, and the theodolite for measuring angles.

ENGINEERS in the United States Navy are commissioned officers having charge of the machinery of steam-vessels. A thorough practical education in the construction and management of steam machinery is required. In military law they are eonsidered non-combatants.

ENGINEERS, CORPS OF, the body of engineers of the U. States army, the duties of which consist of all kinds of surveying, reconnoitering, constructino of fortifications, planning of all defensive works, laying out of routes, and constructing roads and bridges. The engineers are regarded as combatant and often take part in battle, although their proper work is often more important than mere fighting.

ENGLAND, including Wales, the southern and larger portion of the island of Great Britain, is situated between 50° and 55° 46′ n. lat., and 1° 46′ e. and 5° 42′ w. lon. On the n. it is bounded by Scotland; on all other sides it is washed by the sea; on the e. by thc North Sea or German Ocean; on the s. by thc English Channel; and on the w. by St. George's Channel and the Irish Sea. The area is 37,319,221 acres or 58,311 square miles, of which 32,597,398 acres or 50,933 square miles are in England, and 4,721,-823 acres or 7378 square miiles in Wales. This is exclusive of the Channel Islands and the Isle of Man, which together would add 193,647 acres or 302 square miles more to the area. For population, etc., see Britain.

The capital of England and of the British Empire is London. The cities next in size (in order of population) are: Liverpool, Manchester and Salford, Birmingham, Leeds, Sheffield, Bristol, Nottingham, Bradford, and Hull.

The chief indentations are: on thc east the Humber, the Wash, and the Thames estuary; on the west, the Solway Firth, Morecambe Bay, Cardigan Bay, and the Bristol Channel; those on the south are less prominent, though including some useful harbors. The chief islands are: Holy Island, the Farne Islands, Sheppy, and Thanet on the east coast; the Isle of Wight on the south; the Scilly Isles at the south-west extremity; and Lundy Island, Anglesey, Holyhead, and Walney on the west.

The loftiest heights of England and Wales are situated at no great distance from its western shores, and consist, not so much of a continuous chain as of a succession of mountains and hills, stretching, with some interruptions,from north to south, and throwing out numerous branches on both sides, but particularly to the west, where all the culminating summits are found. Amid these mountains lie the celebrated English lakes, of which the most important are Windermere, Derwent Water, Coniston Lake, and Ullswater. Here also is the highest summit of Northern England, Scawfell (3210 feet). A large part of the surface of England consists of wide valleys and plains. Beginning in the north the first valleys on the east side are those of the Coquet, Tyne, and Tees; on the west the beautiful valley of the Eden, gradually widens out into a plain of about 470 square miles, with the town of Carlisle in its center. The most important of the northern plains is the Vale of York, which has an area of nearly 1000 sq. miles. Properly speaking it is still the same plain which stretches, with scarcely a single interruption, across the counties of Lincoln, Suffolk, and Essex, to the mouth of the Thames, and to a considerable distanee inland, comprising the Central Plain and the region of the Fens. On the west side of the island, in S. Lancashire and Cheshire, is the fertile Cheshire Plain.

England is well supplied with rivers, many of them of great importance to industry and commerce. Most of them carry their waters to the North Sea. If we consider the drainage as a whole, four principal river basins may be distinguished, those of the Thames, Wash, and Humber belonging to the German Ocean and the Severn belonging to the Atlantic. In regard to minerals, manufacturing, etc., see Britain.

The history of England proper begins when it ceased to be a Roman possession. On the withdrawal of the Roman forces, about the beginning of the 5th century A.D., the South Britons, or inhabitants of what is now called England, were no longer able to withstand the attacks of their ferocious northern neighbors, the Scots and Picts. In the middle of the 5th century the occasional Teutonic incursions gave place to persistent invasion with a view to settlement. These Teutonic invaders were Low German tribes from the country about the mouths of the Elbe and the Weser, the three most prominent being the Angles, the Saxons, and the Jutcs. Of these the Jutes were the first to form a settlement, taking possession of part of Kent, the Isle of Wight, etc., but the larger conquests of the Saxons in the south and the Angles in the north gave to these tribes the leading place in the kingdom. The struggle continued 150 ycars, and at thc end of that period the whole southern part of Britain, with the exception of Strathclyde, Wales, and West Wales (Cornwall) was in the hands of the Teutonic tribes. This conquered territory was divided among a number of small states or petty chieftaincies.

While this work of conquest and of inter-tribal strife had been in progress toward the establishment of a united kingdom, certain important changes had occurred. The conquest had been the slow expulsion of a Christian race by a purely heathen race, and the country had returned to something of its old isolation with regard to the restofEurope. But long before the close of the 6th century Christianity had secured a footing. The legal and political changes immediately consequent upon the adoption of Christianity were not great, but there resulted a more intimate relation with Europe and the older civilizations, the introduction of new learning and culture the formation of a written literature, and the fusion of the tribes and petty kingdoms into a eloser and more lasting unity than that which could have been otherwise secured.

The kingdom, however, was still kept in a state of disturbance by the attacks of the Danes, who had made repeated incursions during the whole of the Saxon period, and about half a century after the unification of the kingdom became for the moment masters of nearly the whole of England. But the genius of Alfred the Great, who had ascended the throne in 871, speedily reversed matters by the defeat of the Danes at Ethandune (878). Guthrum, their king, embraced Christianity, became the vassal of the Saxon king, and retired to a strip of land on the east eoast including Northumbria and called the Danelagh. During the 10th century many changes had taken place in the Teutonic constitution. Feudalism was already taking root; the king's authority had increased; the folkland was being taken over as the king's personal property; the nobles by birth, or ealdormen, were becoming of less importance in administration than the nobility of thegns, the officers of the king's court. Animosities between the English and the Danes who had settled among them became daily more violent, and a general massacre of the latter took place in 1002. The following year Sweyn invaded the kingdom with a powerful army and assumed the crown of England. Ethelred was compelled to take refuge in Normandy; and though he afterward returned, he found in Canute and adversary no less formidable than Sweyn. Ethelred left his kingdom in 1016 to his son Edmund, who displayed great valor, but was compelled to divide his kingdom with Canute; and when he was assassinated in 1017 the Danes succeeded to the sovereignty of the whole.

Canute (Knut), who espoused the widow of Ethelred, that he might reconcile his new subjects, obtained the name of Great, not only on account of his personal qualities, but from the extent o his dominions, being master of Denmark and Norway as well as England. I 1035 he died, and in England was fol lowed by other two Danish kings Harold and Hardicanute, whose join reigns lasted till 1042, after which th English line was again restored in th person of Edward the Confessor. E

ENGLAND AND WALES

SCALE OF MILES
0 10 20 30 40 50 60

Population _____ 23,944,459
Area square miles _____ 58,311

Longitude West 5° from Greenwich

SCOTLAND
NORTH CHANNEL
IRELAND
IRISH SEA
NORTH SEA
ENGLISH CHANNEL
BRISTOL CHANNEL
ST. GEORGE'S CHANNEL

Loch Lomond
Dumbarton
Greenock
Glasgow
Clyde
Lanark
Peebles
Coldstream
Tweed
Flodden
Belford
Farn Is
Holy Isl
Dunstanborough Pt.
N. Sunderland
Wooler
Cheviot
Hawick
Carter Fell
Alnwick
R. Aln
Alnemouth
Coquet Isl.
Rothbury
Warkworth
Otterburne
Peel Fell
Coquet River
CHEVIOT HILLS
NORTHUMBERLAND
Bellingham
Morpeth
Cowpen
Blyth
N. Shields
Tynemouth
Newcastle
Wark
Tweed R.
Tyne R.
Derwent R.
Hexham
Allendale
Shields
Sunderland
Seaham
Ayr
Firth of Clyde
Arran
Ayrshire
River Nith
Dumfries
Annan
Longtown
Haltwhistle
Solway Firth
Silloth
Carlisle
Brampton
Allonby
Wigton
Alston
Alston Moor
Stanhope
Durham
Hartlepool
Sedgefield Bay
Auckland
Bishop Auckland
Wigtown
Port Patrick
Luce Bay
Burrow Hd.
Mull of Galloway
Belfast
Strangford Lake
Maryport
Workington
Cockermouth
Whitehaven
St. Bees Head
Egremont
Skiddaw
Cross Fell
Penrith
CUMBERLAND
DURHAM
Darlington
Stockton
Middlesborough
Gulsborough
Yarm
Whitby
Robin Hood Bay
Esk River
Ayr Point
Ramsey
Dowpatrick
Snae Fell
ISLE OF MAN
Peel
Douglas
Castletown
Point Erin
Calf of Man
Ravenglass
Lake Coniston
Windermere
Lake
Kirkby Kendal
Dent
Sep Fell
Ambleside
Keswick
Water
Helvellin
Shap
Barnard Castle
Tees
WESTMORLAND
Kirkby Stephen
Heeth
Richmond
NORTH RIDING
Muker
River
Leyburn
North Allerton
Pickering
Scarborough
Broughton
Bootle
Ulverstone
Barrow
Kirkby Lonsdale
Wharfe
Wensleydale
Askrigg
Bedale
Thirsk
New Malton
Filey
Derwent R.
Hodder
Ribble
Lune
Dent
Hornby
Settle
Masham
Ripon
Borrowbridge
Bridlington
Flamborough Hd.
Bridlington Bay
Great Driffield
Walney Isl.
Morecambe Bay
Lancaster
Patterdale
Harrogate
Ripley
YORK
Garstang
Skipton
Knaresborough
Helsey
Tadcaster
York
Pocklington
Market Weighton
Beverley
Hornsea
Fleetwood
Preston
Ribble
Wharfe
Aire River
Leeds
Selby
Howden
Kingston upon Hull
Hedon
Withernsea
Patrington
Spurn Head
Humber
Blackpool
R. Wyre
Kirkham
Poulton
Clitheroe
Bradford
Halifax
WEST RIDING
Lytham
Burnley
Blackburn
Chorley
Rochdale
Huddersfield
Wakefield
Pontefract
Gooler
Thorne
Barton
Glanford Briggs
Gt. Grimsby
Southport
Ormskirk
Bolton
Bury
Oldham
Wigan
Manchester
Barnsley
Doncaster
Aldwark
Don River
Formby Pt.
River Mersey
Holmfirth
Penistone
Mexborough
Rotherham
Sheffield
Peak
Derwent R.
Trent R.
Gainsborough
Saltfleet
Carnels Pt.
Amlwch
Holyhead
Llanerchymedd
ANGLESEY
Beaumaris
Holy Isl.
Beaumaris Bay
Gt. Ormes Hd.
Liverpool
Warrington
Stockport
Garston
Neston
Holywell
River Dee
Chapel en le Frith
Castleton
Buxton
Macclesfield
Bollicorn
Worksop
Retford
Market Rasen
Louth
Alford
Ingoldmells Pt.
Skegness
Carnarvon Bay
Menai Strait
CAERNARVON
Caernarvon
Snowdon
Bangor
Conway
St. Asaph
Denbigh
Llanwrst
Mold
Chester
Northwich
Middlewich
Congleton
Leek
Longnor
Matlock
Chesterfield
Ollerton
Retford
Lincoln
Tuxford
Horncastle
Spilsby
Walnfleet
Tattershall
Newark
Bollinbroke
New Bollinbroke
Wainfleet
Sleaford
Boston
Cley
Cromer
Holt
Wells
Eakenham
North Walsham
Aylsham
Kings Lynn
East Dereham
Swaffham
Norwich
Yarmouth
Lowestoft
Beccles
Southwold
Halesworth
Saxmundham
Framlington
Aldborough
Orford Ness
Woodbridge
Ipswich
Hadleigh
Felixtow
Harwich
The Naze
Colchester
Blackwater R.
Stour R.
Sudbury
Lavenham
Stow Market
Linton
Saffron Walden
Royston
Baldock
Thaxted
Bishop Stortford
Hertford
Cheimsford
Ongar
Ingatestone
Brentwood
Romford
Rochford
Foulness
Mouth of the Thames
Barking
Southend
Gravesend
Sheppy Isl.
Margate
N. Foreland
Ramsgate
Canterbury
Whitstable
Faversham
Chatham
Rochester
Croydon
Epsom
Maidstone
Tonbridge Wells
Ashford
Folkestone
S. Foreland
Dover
Deal
Romney
Hythe
Rye
New Romney
Dungeness
Winchelsea
Hastings
Battle
Lewes
Hailsham
Eastbourne
Beachy Hd.
Newhaven
Brighton
Shoreham
Worthing
Arundel
Chichester
Selsea Bill
Portsmouth
Gosport
Southampton
Lymington
Newport
Ryde
Isle of Wight
Ventnor
Needles
Solent
Spithead
Bognor
Petersfield
Midhurst
Farnham
Guildford
Dorking
Reigate
Godalming
Haslemere
Alton
Andover
Basingstoke
Overton
Winchester
Romsey
Petworth
Horsham
East Grinstead
Uckfield
Ockham
Worcester
Stratford upon Avon
Southam
Warwick
Leamington
Rugby
Coventry
Birmingham
Tunbridge
Dudley
Stourbridge
Bridgenorth
Wenlock
Shrewsbury
Wolverhampton
Atherstone
Lutterworth
Daventry
Northampton
Towcester
Brackley
Buckingham
Bedford
Amthill
Biggleswade
Sandy
Ampthill
Dunstable
Hitchin
Baldock
Royston
Saffron Walden

ward was a weak prince, and in the latter years of his reign had far less real power than his brother-in-law Harold, son of the great earl Godwin. On Edward's death in 1066 Harold accordingly obtained the crown. He found, however, a formidable opponent in the second-cousin of Edward, William of Normandy who instigated the Danes to invade the northern counties, while he, with 60,000 men, landed in the south. Harold vanquished the Danes, and hastening southwards met the Normans near Hastings, at Senlac, afterwards called Battle. Harold and his two brothers fell (Oct. 14, 1066), and William (1066–87) immediately claimed the government as lawful king of England, being subsequently known as William I., the Conquerer.

At his death, in 1087, William II., commonly known by the name of Rufus, the conqueror's second son, obtained the crown, Robert, the eldest son, receiving the duchy of Normandy. In 1100, when William II. was accidently killed in the New Forest, Robert was again cheated of his throne by his younger brother Henry (Henry I.), who in 1106 even wrested from him the duchy of Normandy. He supported his quarrel with firmness, and brought it to a not unfavorable issue. His reign was also marked by the suppression of the greater Norman nobles in England, whose power threatened to overshadow that of the king, and by the substitution of a class of lesser nobles. In 1135 he died in Normandy, leaving behind him only a daughter, Matilda.

By the will of Henry I. his daughter Maud or Matilda, wife of Godfrey Plantagenet, Count of Anjou, and frequently styled the Empress Matilda, because she had first been married to Henry V., emperor of Germany, was declared his successor. But Stephen, son of the Count of Blois, and of Adela, daughter of William the Conqueror, raised an army in Normandy, landed in England, and declared himself king. After years of civil war and bloodshed an amicable arrangement was brought about, by which it was agreed that Stephen should continue to reign during the remainder of his life, but that he should be succeeded by Henry, son of Matilda and the Count of Anjou. Stephen died in 1154, and Henry Plantagenet ascended the throne with the title of Henry II., being the first of the Plantagenet or Angevin kings. A larger dominion was united under his sway than had been held by any previous sovereign of England, for at the time when he became King of England he was already in the possession of Anjou, Normandy, and Aquitaine.

Henry II. found far less difficulty in restraining the license of his barons than in abridging the exorbitant privileges of the clergy, who claimed exemption not only from the taxes of the state, but also from its penal enactments, and who were supported in their demands by the primate Becket. Henry was the first who placed the common people of England in a situation which led to their having a share in the government. The system of frank-pledge was revived, trial by jury was instituted by the Assize of Clarendon, and the Eyre courts were made permanent by the Assize of Nottingham.

Richard I., called Cœur de Lion, who in 1189 succeeded to his father, Henry II., spent most of his reign away from England. Having gone to Palestine to join in the third crusade he proved himself an intrepid soldier. Returning homeward in disguise through Germany he was made prisoner by Leopold, duke of Austria, but was ransomed by his subjects. In the meantime John, his brother, had aspired to the crown, and hoped, by the assistance of the French, to exclude Richard from his right. Richard's presence for a time restored matters to some appearance of order; but having undertaken an expedition against France, he received a mortal wound at the siege of Chalons, in 1199.

John was at once recognized as King of England, and secured possession of Normandy; but Anjou, Maine, and Touraine acknowledged the claim of Arthur, son of Geoffrey, second son of Henry II. On the death of Arthur, while in John's power, these four French provinces were at once lost to England. John's exactions and misgovernment had equally embroiled him with the nobles. In 1213 they refused to follow him to France, and on his return defeated, they at once took measures to secure their own privileges and abridge the prerogatives of the crown. King and barons met at Runnymede, and on June 15, 1215, the Great Charter (Magna Charta) was signed. In 1216, however, John died, and his turbulent reign was succeeded by the almost equally turbulent reign of Henry III.

During the first years of the reign of Henry III. the abilities of the Earl of Pembroke, who was regent until 1219, retained the kingdom in tranquility; but when, in 1227, Henry assumed the reins of government he showed himself incapable of managing them.

On the death of Henry III., in 1272, Edward I. succeeded without opposition. From 1276 to 1284 he was largely occupied in the conquest and annexation of Wales. In 1292 Balliol, whom Edward had decided to be rightful heir to the Scottish throne, did homage for the fief to the English king; but when, in 1294, war broke out with France, Scotland also declared war. The Scots were defeated at Dunbar (1296), and the country placed under an English regent; but the revolt under Wallace (1297) was followed by that of Bruce (1306), and the Scots remained unsubdued. In 1295 the first perfect parliament was summoned, the clergy and barons by special writ, the commons by writ to the sheriffs directing the election of two knights from each shire, two citizens from each city, two burghers from each borough. The great aim of Edward, to include England, Scotland, and Wales in one kingdom proved a failure, and he died in 1307 marching against Robert Bruce.

The reign of his son Edward II. was unfortunate to himself and to his kingdom. He made a feeble attempt to carry out his father's last and earnest request to prosecute the war with Scotland, but the English were almost constantly unfortunate; and at length, at Bannockburn (1314), they received a defeat from Robert Bruce which insured the independence of Scotland. He died in 1327.

The reign of Edward III. was as brilliant as that of his father had been the reverse. The main projects of the third Edward were directed against France, the crown of which he claimed in 1328 in virtue of his mother, the daughter of King Philip. The victory won by the Black Prince at Crecy (1346), the capture of Calais (1347), and the victory of Poitiers (1356), ultimately led to the Peace of Brétigny in 1360, by which Edward III. received all the west of France on condition of renouncing his claim to the French throne. Before the close of his reign, however, these advantages were all lost again, save a few principal towns on the coast.

Edward III. was succeeded in 1377 by his grandson Richard II., son of Edward the Black Prince. The people of England now began to show, though in a turbulent manner, that they had acquired just notions of government. In 1380 an unjust and oppressive poll-tax brought their grievances to a head, and 100,000 men, under Wat Tyler, marched toward London (1381). Wat Tyler was killed while conferring with the king, and the prudence and courage of Richard appeased the insurgents. Despite his conduct on this occasion Richard was deficient in the vigor necessary to curb the lawlessness of the nobles. In 1398 he banished his cousin, Henry Bolingbroke and on the death of the latter's father, the Duke of Lancaster, unjustly appropriated his cousin's partimony. To avenge the injustice Bolingbroke landed in England during the king's absence in Ireland, and at the head of 60,000 malcontents compelled Richard to surrender. He was confined in the Tower, and despite the superior claims of Edmund Mortimer, Earl of March, Henry was appointed king (1399), the first of the House of Lancaster, Richard was, in all probability, murdered early in 1400.

The manner in which the Duke of Lancaster, now Henry IV., acquired the crown rendered his reign extremely turbulent, but the vigor of his administration quelled every insurrection. During the reign of Henry IV. the clergy of England first began the practice of burning heretics under the act de haeretico comburendo, passed in the second year of his reign. Henry died in 1413, leaving his crown to his son, Henry V., who revived the claim of Edward III. to the throne of France in 1415, and invaded that country at the head of 30,000 men. The disjointed councils of the French rendered their country an easy prey; the victory of Agincourt was gained in 1415; and after a second campaign a peace was concluded at Troyes in 1420, by which Henry received the hand of Katherine, daughter of Charles VI., was appointed regent of France during the reign of his father-in-law, and declared heir to the throne on his death. The two kings, however, died within a few weeks of each other in 1422, and the infant son of Henry thus became king of England (as Henry VI.) and France at the age of nine months.

ENGLAND

England during the reign of Henry VI. was subjected, in the first place, to all the confusion incident to a long minority, and afterward to all the misery of a civil war. In France (1422–53) the English forces lost ground, and were finally expelled by the celebrated Joan of Arc, Calais alone being retained. The rebellion of Jack Cade in 1450 was suppressed only to be succeeded by more serious trouble. In that year Richard, duke of York, the father of Edward, afterward Edward IV., began to advance his pretensions to the throne, which had been so long usurped by the house of Lancaster. The wars which resulted, called the Wars of the Roses, from the fact that a red rose was the badge of the house of Lancaster and a white one that of the house of York, lasted for thirty years, from the first battle of St. Albans, May 22, 1455, to the battle of Bosworth, Aug. 22, 1485. Henry VI. was twice driven from the throne (in 1461 and 1471) by Edward of York, whose father had previously been killed in battle in 1460. Edward of York reigned as Edward IV. from 1461 till his death in 1483, with a brief interval in 1471; and was succeeded by two other sovereigns of the house of York, first his son Edward V., who reigned for eleven weeks in 1483; and then by his brother Richard III., who reigned from 1483 till 1485, when he was defeated and slain on Bosworth field by Henry Tudor, of the House of Lancaster, who then became Henry VII.

Henry VII. was at this time the representative of the house of Lancaster and in order at once to strengthen his own title, and to put to an end the rivalry between the houses of York and Lancaster, he married in 1486 Elizabeth, sister of Edward V. and heiress of the house of York. His administration throughout did much to increase the royal power and to establish order and prosperity. He died in 1509.

The authority of the English crown, which had been so much extended by Henry VII., was by his son Henry VIII. exerted in a tyrannical and capricious manner. The most important event of the reign was undoubtedly the Reformation; though it had its origin rather in Henry's caprice and in the casual situation of his private affairs than in his conviction of the necessity of a reformation in religion, or in the solidity of reasoning employed by the reformers. Henry had been espoused to Catherine of Spain, who was first married to his elder brother Arthur, a prince who died young. Henry became disgusted with his queen, and enamored of one of her maids of honor, Anne Boleyn. He had recourse, therefore, to the pope to dissolve a marriage which had at first been rendered legal only by a dispensation from the pontiff; but failing in his desires he broke away entirely from the Holy See, and in 1534 got himself recognized by act of parliament as the head of the English Church. He died in 1547. He was married six times, and left three children, each of whom reigned in turn. These were: Mary, by his first wife, Catherine of Aragon; Elizabeth, by his second wife, Anne Boleyn; and Edward, by his third wife, Jane Seymour.

Edward, who reigned first, with the title of Edward VI., was nine years of age at the time of his succession, and died in 1553, when he was only sixteen. His short reign, or rather the reign of the Earl of Hertford, afterward Duke of Somerset, who was appointed regent, was distinguished chiefly by the success which attended the measures of the reformers, who acquired great part of the power formerly engrossed by the Catholics. The intrigues of Dudley, duke of Northumberland, during the reign of Edward, caused Lady Jane Grey to be declared his successor; but her reign, if it could be called such, lasted only a few days. Mary, daughter of Henry VIII., was placed upon the throne, and Lady Jane Grey and her husband were both executed. Mary, a bigoted Catholic, seems to have wished for the crown only for the purpose of re-establishing the Roman Catholic faith. Political motives had induced Philip of Spain to accept of her a spouse; but she could never prevail on her subjects to allow him any share of power. She died in 1558.

Elizabeth, who succeeded her sister Mary, was attached to the Protestant faith, and found little difficulty in establishing it in England. Having concluded peace with France (1559), Elizabeth set herself to promote the confusion which prevailed in Scotland, to which her cousin Mary had returned from France as queen in 1561. In this she was so far successful that Mary placed herself in her power (1568), and after many years' imprisonment was sent to the scaffold. (1587). As the most powerful Protestant nation, and as a rival to Spain in the New World, it was natural that England should become involved in difficulties with that country. The dispersion of the Armada by the English fleet under Howard, Drake, and Hawkins was the most brilliant event of a struggle which abounded in minor feats of valor.

To Elizabeth succeeded (in 1603) James VI. of Scotland and I. of England, son of Mary Queen of Scots and Darnley. His accession to the crown of England in addition to that of Scotland did much to unite the two nations, though a certain smouldering animosity still lingered. His son Charles I., succeeded him in 1625, and his marriage with a Catholic, his arbitrary rule, and illegal methods of raising money, provoked bitter hostility. Under the guidance of Laud and Strafford things went from bad to worse. Civil war broke out in 1642 between the king's party and that of the parliament, and the latter proving victorious, in 1649 the king was beheaded.

A commonwealth or republican government was now established, in which the most prominent figure was Oliver Cromwell. Mutinies in the army among Fifth-monarchists and Levellers were subdued by Cromwell and Fairfax, and Cromwell in a series of masterly movements subjugated Ireland and gained the important battles of Dunbar and Worcester. At sea, Blake had destroyed the Royalist fleet under Rupert, and was engaged in an honorable struggle with the Dutch under Van Tromp. But within the governing body matters had come to a deadlock. A dissolution was necessary, yet parliament shrank from dissolving itself, and in the meantime the reform of the law, a settlement with regard to the church, and other important matters remained untouched. In April, 1653, Cromwell cut the knot by forcibly ejecting the members and putting the keys of the house in his pocket. From this time he was practically head of the government, which was vested in a council of thirteen. A parliament—the Little or Barebones Parliament—was summoned, and in the December of the same year Cromwell was installed Lord Protector of the Commonwealth of England, Scotland, and Ireland. With more than the power of a king, he succeeded in dominating the confusion at home and made the country feared throughout the whole of Europe. Cromwell died in 1658, and the brief and feeble protectorate of his son Richard followed.

There was now a wide-spread feeling that the country would be better under the old form of government, and Charles II., son of Charles I., was called to the throne by the Restoration of 1660. He took complete advantage of the popular reaction from the narrowness and intolerance of Puritanism, and even latterly endeavored to carry it to the extreme of establishing the Catholic religion.

As Charles II. left no legitimate issue, his brother the Duke of York succeeded him as James II. (1685–88). An invasion by an illegitimate son of Charles, the Duke of Monmouth, who claimed the throne, was suppressed, and the king's arbitrary rule was supported by the wholesale butcheries of such instruments as Kirke and Jeffreys. The king's zealous countenance of Roman Catholicism and his attempts to force the church and the universities to submission provoked a storm of opposition. The whole nation was prepared to welcome any deliverance, and in 1688 William of Orange, husband of James' daughter Mary, landed in Torbay. James fled to France, and a convention summoned by William settled the crown upon him, he thus becoming William III. Annexed to this settlement was a Declaration of Rights circumscribing the royal prerogative by depriving him of the right to exercise dispensing power, or to exact money, or maintain an army without the assent of parliament. This placed henceforward the right of the British sovereign to the throne upon a purely statutory basis. A bill for triennial parliaments was passed in 1694, the year in which Queen Mary died. For a moment after her death William's popularity was in danger, but his successes at Namur and elsewhere, and the obvious exhaustion of France, once more confirmed his power. The treaty of Ryswick followed in 1697, and the death of James II. in exile in 1701 removed a not unimportant source of danger. Early in the following year William also died, and by the act of settlement Anne succeeded him.

The closing act of William's reign had been the formation of the grand alliance between England, Holland, and the German Empire, and the new queen's rule opened with the brilliant successes of Marlborough at Blenheim (1704) and Ramilies (1706). Throughout the earlier part of her reign the Marlboroughs

practically ruled the kingdom, the duke's wife, Sarah Jennings, being the queen's most intimate friend and adviser. In 1707 the history of England becomes the history of Britain, the Act of Union passed in that year binding the parliaments and realms of England and Scotland into a single and more powerful whole. See art. Britain.

The first religion of the Celts of England was Druidism. It has been conjectured that Christianity may have reached Britain by way of France (Gaul) before the conclusion of the 1st, or not long after the commencement of the 2d century, but the period and manner of its introduction are uncertain. It had, however, made considerable progress in the island previous to the time of Constantine the Great (306–337).

A period of almost total eclipse followed the inroad of the pagan Saxons, and it was not until A.D. 570 that signs of change showed themselves in the new nationality. On the coming of Austin, or St. Augustine, sent over in 596 by Gregory, the Great, a residence at Canterbury was assigned to him, and Ethelbert, king of Kent, and most of his subjects, adopted Christianity.

The clergy in course of time attained, particularly after the Norman conquest, to such a height of domination as to form an imperium in imperio. Under Anselm (1093–1109) the church was practically emancipated from the control of the state, and the power of the pope became supreme. With the reign of Edward I. the new system of parliaments came as an effective rival of the church synods, and various acts restrained the power of the clergy. In the 14th century the teaching of Wickliffe promised to produce a thorough revolt from Rome; but the difficulties of the house of Lancaster which drove its members to propitiate the church, and the Wars of the Roses, prevented matters coming to a head.

A steady decay of vital power set in however, and when Henry VIII. resolved to recast the English church there was no effective protest. In 1534 the papal authority was set aside by act of parliament, and by another act of parliament, passed in 1535, Henry assumed the title of supreme head of the Church of England.

With the reign of Mary the old religion was re-established; and it was not till that of Elizabeth that the Church of England was finally instituted in its present form. The doctrines of the Church were again modified, and the forty-two articles were reduced to thirty nine by the convocation of the clergy in 563. As no change was made in the episcopal form of government, and some rites and ceremonies were retained which many of the reformed considered as superstitious, this circumstance gave rise to many future dissensions. In 1559 before the close of the first year of Elizabeth's reign, the Acts of Supremacy and Uniformity were passed with the object of bringing about the entire subjection of the church and the people in religious matters to the royal authority.

From James I. some relief was anticipated by Puritans and nonconformists, but they were disappointed. Under Charles I. the attempt was made, through the instrumentality of Laud, to reduce all the churches of Great Britain under the jurisdiction of bishops. But after the death of Laud the parliament abolished the episcopal government, and condemned everything contrary to the doctrine, worship, and discipline of the Church of Geneva. In the reign of William III., and particularly in 1689, the divisions among the friends of Episcopacy gave rise to the two parties called the high-churchmen or non-jurors, and low-churchmen. The former maintained the doctrine of passive obedience to the sovereign; that the hereditary succession to the throne is of divine institution; that the church is subject to the jurisdiction of God alone; etc. The gradual progress of civil and religious liberty since that time has settled practically many such controversies.

As at present constituted the established religion of England is Episcopacy. The sovereign is the supreme head. The church is governed by two archbishops and thirty-one bishops. The Archbishop of Canterbury is styled the primate of all England, and to him belongs the privilege of crowning the kings and queens of England. The province of Canterbury comprehends 24 bishoprics; in the province of the Archbishop of York, who is styled primate of England, there are 9 bishoprics, the province comprising Cheshire, Lancashire, Yorkshire, and the other northern counties. Archbishops and bishops are appointed by the sovereign by what is called a congé d'élire, or leave to elect, naming the person to be chosen and sent to the dean and chapter. The archbishops and bishops, to the number of 24, have seats in the House of Lords, and are styled spiritual lords. As regards architecture little can be said with regard to the style prevalent between the invasion of the Anglo-Saxons and the Norman Conquest, from the fact that the remains of buildings erected in England before the Conquest are few and insignificant. The Norman style was introduced in the reign of Edward the Confessor, though the workmen, both then and after the Conquest, being English, the earlier work preserved many native characteristics. The Norman period proper extends from about 1090 to 1150, some of the best examples being parts of the cathedrals of Rochester, Winchester, Durham, and Canterbury. In the brief period 1160 to 1195 a marked change took place in the adoption of the pointed arch and what is known as the Early English style. Improved methods of construction led to the use of lighter walls and pillars instead of the heavy masses employed in the Norman style. Narrow lancet-shaped windows took the place of the round arch; bold projecting buttresses were introduced; and the roofs and spires became more lofty and more pointed, while in the interiors pointed arches rested on lofty clustered pillars. The best Early English type is Salisbury Cathedral. The Early English style has been regarded as lasting from 1190 to 1270, when the Decorated style of Gothic began to prevail. The transition to the Decorated style was gradual, but it may be considered as lasting to 1377. Exeter Cathedral is an excellent example of the earliest Decorated style. Between 1360 and 1399 the Decorated style gave place to the Perpendicular, which prevailed from 1377 to 1547, and was an exclusively English style. Gothic architecture, though it lingered on in many districts, practically came to an end in England in the reign of Henry VIII. The Elizabethan and Jacobean styles which followed were transitions from the Gothic to the Italian, with which these styles were more or less freely mixed. About 1836 the Gothic revival commenced, and that style has been employed with considerable success in the churches erected in recent times. At the present day Gothic is much employed for ecclesiastical and collegiate buildings, and a mild type of Renaissance for civil buildings. Of late years a style that has received the name of "Queen Anne" is much in vogue for private residences. It is very mixed, but withal highly picturesque. The most striking novelties in the 19th century have been introduced by the extensive use of iron and glass, as exemplified in the Exhibition building of 1851, the Crystal Palace, Sydenham, and the great railway-stations.

Very little is known of the state of the art of painting among the Anglo-Saxons; but in the 9th century Alfred the Great caused numerous MSS. to be adorned with miniatures, and about the end of the 10th century Archbishop Dunstan won reputation as a miniature painter. Under William the Conqueror and his two sons the painting of large pictures began to be studied, and Lanfranc, archbishop of Canterbury, adorned the vault of his church with paintings. Numerous miniatures of the 13th and 14th centuries have come down to us, rude in execution, but not without originality. Of native artists few are of importance prior to that original genius William Hogarth (1697–1764). Throughout the 18th century English artists attained higher eminence in portrait painting than in other departments, and it culminated in Sir Joshua Reynolds (1723–92), Thomas Gainsborough (1727–88), and Romney (1734-1802). Landscape-painting was represented by Richard Wilson, 1714–82, who painted classical scenes with figures from heathen mythology, and by Gainsborough already mentioned, who painted scenes of English nature and humble life. The Royal Academy of Arts, of which Reynolds was the first president, was established in London in 1769. In landscape the reputation of Turner (1775–1857) "stands alone, solitary, colossal." In historical painting Hilton (1786–1839), Eastlake (1793–1865), Etty (1787–1849), E. M. Ward (1816–97), C. W. Cope (b. 1811), and D. Maclise (1811-70) attained celebrity. Landseer (1802-73) stands by himself as a painter of animals.

In 1824 the nucleus of the National Gallery was formed by the purchase of the Angerstein collection, and in 1832 the vote was passed for the erection of the National Gallery building.

The modern group of British painters may be held to date from about 1850. Prominent among these the following may be named: In historical painting

Leighton, Alma-Tadema, Watts, Poynter, Long, Goodall, Holman Hunt, Noel Paton, Burne-Jones, and Madox Brown, as also W. P. Frith, whose Derby Day and Railway Station, so descriptive of modern life, may well be classed as historical. In figure painting or genre T. Faed, Erskine Nicol, Fildes, Orchardson, Herkomer, and Pettie. In portraiture Millais, Frank Holl, Ouless, and Richmond. In landscape Linnell, Hook, Peter Graham, John Brett, Vicat Cole, H. Moore, and Keeley Halswelle. In water-colors the most eminent artists have been Girtin (1773–1802), Cotman (1782–1842), Liverseege (1803–32), Stothard (1755–1834), Turner, David Cox (1788–1859), De Wint (1784–1849), Copley Fielding (1787–1855), Barret (1774–1842), Samuel Prout (1783–1852), W. H. Hunt (1790–1864), Louis Haghe (1806–85), W. L. Leitch (1804–83, Sam Bough (1822–74), J. F. Lewis (1805–76).

The language spoken in England from the settlement of the Anglo-Saxons to the Norman Conquest (say 500–1066) is popularly known as Anglo-Saxon, though simply the earliest form of English. (See Anglo-Saxons.) It was a highly inflected and purely Teutonic tongue presenting several dialects. The Conquest introduced the Norman-French, and from 1066 to about 1250 two languages were spoken, the native English speaking their own language, the intruders speaking French. During this period the grammatical structure of the native language was greatly broken up, inflexions fell away, or were assimilated to each other; and towards the end of the period we find a few works written in a language resembling the English of our own day in grammar, but differing from it by being purely Saxon or Teutonic in vocabulary. Finally, the two languages began to mingle, and form one intelligible to the whole population, Normans as well as English, this change being marked by a great infusion of Norman-French words, and English proper, being the result. English is thus in its vocabulary, a composite language, deriving part of its stock of words from a Teutonic source and part from a Latin source, Norman-French being in the main merely a modified form of Latin. In its grammatical structure and general character, however, English is entirely Teutonic, and is classed with Dutch and Gothic among the Low German tongues. If we divide the history of the English language into periods we shall find three most distinctly marked: 1st, the Old English or Anglo-Saxon, extending down to about 1100; 2d, the Middle English, 1100–1400 (to this period belong Chaucer, Wickliffe, Langland); 3d, Modern English. A more detailed subdivision would give transition periods connecting the main ones. The chief change which the language has experienced during the modern period consists in its absorbing new words from all quarters in obedience to the requirements of advancing science, more complicated social relations, and increased subtlety of thought. At the present time the rapid growth of the sciences already existing, and the creation of new ones, have caused whole groups of words to be introduced, chiefly from the Greek.

Before any English literature, in the strict sense of the term, existed, four literatures had arisen in England—the Celtic, Latin, Anglo-Saxon, and Anglo-Norman. With the coming of the Normans, although the Anglo-Saxon chronicle was continued until 1154, the native language practically ceased for a time to be employed in literature, Latin being employed in law, history, and philosophy, French in the lighter forms of literature.

Apart from a few brief fragments, the first English writings after the Conquest are the Brut of Layamon (about 1200), based on the Brut of Wace; and the Ormulum, a collection of metrical homilies attributed to Orm or Ormin, an Augustine monk. Between the beginning and middle of the 14th century the English speech had entered upon a new phase of development in the absorption of Norman-French words. A rapid expansion of the literature followed, having as the foremost figure that of Chaucer (1340–1400), who, writing at first under French influences, and then under Italian, became in the end the most representative English writer of the time.

The period from the time of Chaucer to the appearance of Spenser, that is, from the end of the 14th to near the end of the 16th century, is a very barren one in English literature, in part probably owing to foreign and domestic wars, the struggle of the people toward political power, and the religious controversies preceding and attending the Reformation.

Several events of European importance combined to stimulate life and enlarge the mental horizon—the invention of printing, or rather of movable types, the promulgation of the Copernican system of astronomy, the discovery of America, the Renaissance, and the Reformation. The Renaissance spread from Florence to England by means of such men as Colet, Linacre, Erasmus, and Sir Thomas More (1480–1535), the last noteworthy as at the head of a new race of historians. Important contributions to the prose of the time were the Tyndale New Testament, printed in 1525, and the Coverdale Bible (1535). The first signs of an artistic advance in poetic literature are to be found in Wyatt (1503–42) and Surrey)1516–47), who nationalized the sonnet, and of whom the latter is regarded as the introducer of blank verse.

After the death of James I. the course of literature breaks up into three stages, the first from 1625 to 1640, in which the survivals from the Elizabethan age slowly die away. The second stage (1640–60) was almost wholly given up to controversial prose, the Puritan revolution checking the production of pure literature. In this controversial prose of the time Milton was easily chief. With the restoration a third stage was begun. Milton turned his new leisure to the composition of his great poems; the drama was revived, and Davenant and Dryden, with Otway, Wycherley, and Congreve in their first plays, and minor playwrights, are the most representative writers of the period. Butler established a genre in satire, and Marvell as a satirist in some respects anticipated Swift; Other features of the last part of the 17th century were the immense advance in physical science under Boyle, Isaac Newton, Harvey, and others, and the rise of the newspaper press.

Dryden's death in 1700 marks the commencement of the so-called Augustan age in English literature. During it, however, no greater poet appeared than Pope (1688–1744), in whom sagacity, wit, and fancy take the place of the highest poetic faculty, but who was a supreme artist within the formal limits of his conception of metrical art.

With the French Revolution, or a few years earlier, the modern movement in literature may be said to have commenced. The departure from the old traditions, traceable in Gray and Collins, was more clearly exhibited in the last years of the century in Cowper (1731–1800) and Burns (1759–96), and was developed and perfected in the hands of Blake (1757–1828), Bowles (1762–1850), and the "Lake poets" Wordsworth (1770–1850), Coleridge (1772–1834), and Southey (1774–1843). A more important group was that of Byron (1788–1824), Shelley (1792–1822), and Keats (1796–1821), with which may be associated the names of Leigh Hunt (1784–1859), Thomas Moore (1779–1852), and Landor (1775–1864). Among the earlier writers of fiction there were several women of note, such as Maria Edgeworth (1767–1849) and Jane Austen (1775–1817). The greatest name in fiction is unquestionably that of Scott. Other prose writers were Mackintosh, Malthus, Hallam, James Mill, Southey, Robert Hall, William Hazlitt, Sydney Smith, Francis Jeffrey, Lord Brougham. In the literature since 1830 poetry has included as its chief names those of Hood, Aytoun, Charles Mackay, Philip James Bailey, Elizabeth Barrett Browning, Coventry Patmore, Lord Lytton (Owen Meredith), Matthew Arnold, Dante G. Rossetti, Robert Buchanan, Wm. Morris, Lewis Morris, Jean Ingelow, Swinburne, and last and greatest, Tennyson and Browning. A brilliant list of novelists for the same period includes Marryat, Lord Lytton, Ainsworth Dickens, Thackeray, Charles Kingsley, Charlotte Brontë, Lover, Lever, Wilkie Collins, Mayne Reid, George Macdonald Charles Reade, George Eliot, Anthony Trollope, William Black, Thomas Hardy R. D. Blackmore, George Meredith, Thackeray, and others. To the historical and biographical list belong Alison, Macaulay, Buckle, Carlyle, Grote, Milman, Froude, Lecky, Kinglake, John Richard Green, E. A. Freeman, John Morley, Leslie Stephen. In science and philosophy among the chief writers have been Whewell, Sir W. Hamilton, Mansel, John Stuart Mill, Alexander Bain, Hugh Miller, Charles Darwin, Huxley, Tyndal Max Müller, Herbert Spencer, T. H Green. Of the other prose writers of importance the chief are De Quincey, Harriet Martineau, Sir Arthur Helps, Ruskin Matthew Arnold, W. E. Gladstone.

ENGLISH, Thomas Dunn: poet and physician; born in Philadelphia, 1819 Among his works are several successful dramas, numerous novels, among them Walter Woolfe, a volume of poems, an

American Ballads. The best known of his poems is the popular ballad, Ben Bolt. He died in 1902.

ENGLISH, William Hayden: lawyer and politician; born Lexington, Ind., 1822. Was elected to U. S. House of Representatives in 1852, and three times re-elected, retiring in 1860; was nominated for vice-president of the U. S. by the democratic convention at Cincinnati, Ohio, June 24, 1880. He was president of the Indiana Historical Society, and the author of works on the history and constitution of that state. Died in Indianapolis, 1896.

ENGLISH CHANNEL, the arm of sea which separates England from France, extending, on the English side, from Dover to the Land's End; and on the French, from Calais to the Island of Ushant. On the east it communicates with the German Ocean by the Strait of Dover, 21 miles wide; and on the west it opens into the Atlantic by an entrance about 100 miles wide. At its greatest breadth it is about 150 miles. The pilchard and mackeral fisheries are very important.

ENGRAVING, the art of representing objects and depicting characters on metal, wood, precious stones, etc., by means of incisions made with instruments variously adapted to the substances operated upon and the description of work intended. Impressions from metal plates are named engravings, prints, or plates; those printed from wood being called indifferently wood engravings and wood-cuts. While, however, these impressions are not altogether dissimilar in appearance, the processes are distinct. In plates the lines intended to print are incised, and in order to take an impression the plate is daubed over with a thick ink which fills all the lines. The surface is then wiped perfectly clean, leaving only the incised lines filled with ink. A piece of damp paper is now laid on the face of the plate, and both are passed through the press, which causes the ink to pass from the plate to the paper. This operation needs to be repeated for every impression. In the wood block, on the contrary, the spaces between the lines of the drawing are cut out, leaving the lines standing up like type, the printing being from the inked surface of the raised lines, and effected much more rapidly than plate printing.

Engraving on wood, intended for printing or impressing from, long preceded engraving on metals. The art is of eastern origin, and at least as early as the 10th century engraving and printing from wood blocks was common in China. We first hear of wood engraving being cultivated in Europe by the Italians and Germans in the 13th century. For a hundred and fifty years, however, there is small indication of the practice of the art, which was at first confined to the production of block-books, playing cards, and religious prints. In the 15th century the art of printing from engraved plates was discovered in Florence by Maso Finiguerra. Engraving had long been used as a means of decorating armor, metal vessels, etc., the engravers generally securing duplicates of their work before laying in the niello (a species of metallic enamel) by filling the lines with dark color, and taking casts of them in sulphur. The discovery of the practicability of taking impressions upon paper led to engraving upon copper plates for the purpose of printing from. The date of the earliest known niello proof upon paper is 1452. The substitution of steel for copper plates (1820–30) gave the power of producing a much larger number of fine impressions, and opened new possibilities for highly-finished work. During the closing years of the 18th century line engraving attained a depth of color and fulness of tone in which earlier works generally are deficient, and during the 19th century it reached a perfectness of finish which it had not previously attained. A picture, whether figure or landscape, may be translated by line engraving with all its depths of color, delicacy of tone, and effect of light, and shade; the various textures, whether of naked flesh, silk, satin, woolen, or velvet, all successfully rendered by ingenious modes of laying the lines and combination of lines of varying strength, width, and depth. In the period 1820–60 landscape engraving attained a perfection in Great Britain which it had not attained in any other country, or at any other time. Through lack of encouragement, change of fashion, and the adoption of other methods of reproduction, line engraving is rapidly becoming a lost art.

Line Engraving, as implied by the term, is executed entirely in lines. The tools are few and simple. They consist of the graver or burin, the point, the scraper, and the burnisher; and oil-stone or hone, dividers, a parallel square, a magnifying lens; a bridge on which to rest the hand; a blind or shade of tissue paper, to make the light fall equally on the plate, callipers for levelling important erasures, a small steel anvil, a small pointed hammer, and punches. In etching, the following articles are required: a resinous mixture called etching-ground, capable, when spread very thinly over the plate, of resisting the action of the acids used; a dauber for laying the ground equally; a hand-vise; some hair-pencils of different sizes, and bordering wax, made of burgundy-pitch, bees'-wax, and a little oil.

In engraving, the plate, which is highly polished and must be free from all scratches, is first prepared by spreading over it a thin layer of ground. The surface is then smoked, and the outline of the picture transferred to it by pressure from the paper on which it has been drawn in fine outlines by a black-lead pencil. The picture is then drawn on the ground with the etching-needle, which removes the ground in every form produced by it, and leaves the bright metal exposed. A bank of wax is then put round the plate and diluted acid poured on it, which eats out the metal from the lines from which the ground has been removed, but leaves the rest of the plate untouched. The plate is then gone over with the graver, the etched lines clearly defined, broken lines connected, new lines added, etc. Sometimes the plate is rebitten more than once, those parts which are sufficiently bitten in the first treatment being stopped with varnish, and only the selected parts exposed to after-biting. Finally the burnisher is brought into play alternately with the graver and point to give perfectness and finish. Such is the process for landscape engraving. In historical and portrait engraving of the highest class, the lines are first drawn on the metal with a fine point and then cut in by the graver, first making a fine line and afterward entering and re-entering till the desired width and depth of lines is attained. Much of the excellence of such engravings depends on the mode in which the lines are laid, their relative thickness, and the manner in which they cross each other. In historical engraving etching is but little used, and then only for accessories and the less important parts.

The wood best adapted for engraving is box. It is cut across the grain in thicknesses equal to the height of type, these slices being subjected to a lengthened process of seasoning, and then smoothed, for use. Every wood engraving is the representative of a finished drawing previously made on the block; the unshaded parts being cut away, and the lines giving form, shading, texture, etc., left standing in relief by excavations of varied size and character, made between them by gravers of different forms.

Drawings on wood are made either with black-lead pencil alone or with pencil and indian ink, the latter being employed for the broader and darker masses. It is now much the practice to photograph drawings made in black and white upon the wood instead of making the drawing on the wood block. When the drawing is put on the wood by washes or by photography instead of being entirely done by pencil lines, the engraver has to devise the width and style of lines to be employed instead of cutting in facsimile, as is the case when the drawing is made entirely in lines. The tools required for wood engraving are similar but more numerous than those of the engraver on copper or steel. See also Die-sinking, Gems, Half-tone and Zinc Engraving.

ENGROSSING, in law, denotes extending a deed, that is, rewriting it out fully in fair and legible characters.

ENLIST'MENT, the method by which an army is supplied with troops, as distinguished from conscription. Up to 1802 the enlistment of men for the British army was left in the hands of private undertakers, or middlemen, who received a commission on the recruits they procured; but the abuses of this system induced the government to take the matter into their own management. At an early period enlistment was for short periods, but this was soon changed to enlistment for life. The act of 1847 limited the term of enlistment to ten years for the infantry and twelve for the cavalry, artillery, and ordnance; re-enlistments for periods of eleven and twelve years might be made, after serving which retiring pensions were granted. By the acts of 1870 and 1881 the system of long and short service was introduced. By both acts the term of long service was fixed for twelve years, at the expiration of which period the soldier may re-enlist for other nine years, service for

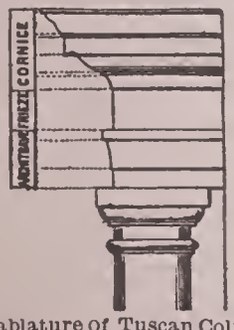
the two terms, or twenty-one years, entitling him to a pension. The short service of the first act extended over six years with the regular army and six years in the first-class reserve; the short service of the act of 1881 is seven years in the regular army and five in the reserve. In the navy a seaman may engage for five or ten years, for the period his ship is in commission, or for a longer period. He receives higher pay for longer service. In the U. States men are enlisted for five years' duty in every branch, and recruits are assigned to regiments by order of the war department.

ENOCH (ē'nok), (1) The eldest son of Cain, who called the city which he built after his name (Gen. IV. 17). (2) One of the patriarchs, the father of Methuselah. He "walked with God; and he was not; for God took him" (Gen. v. 24) at the age of 365 years. The words quoted are generally understood to mean that Enoch did not die a natural death, but was removed as Elijah was.

ENOCH, Book of, an apocryphal book of an assumedly prophetical character, to which considerable importance has been attached on account of its supposed quotation by St. Jude in the 14th and 15th verses of his epistle. It is referred to by many of the early fathers; is of unknown authorship, but was probably written by a Palestinian Hebrew. Its date is also uncertain, critical conjecture ranging from 144 B.C. to 132 A.D.

EN'SIGN, formerly, in the British army, the officer who carried the flag or colors of an infantry regiment; for this title, second lieutenant has been substituted. In naval language the ensign is the flag over the poop or stern which distinguishes the ships of different nations. In the royal navy of Britain it is a flag with a white field divided into quarters by the red cross of St. George, and having the union (or Union Jack as it is commonly called) in the upper corner next the staff. In the United States navy an ensign ranks next below lieutenant.

ENTAB'LATURE, in architecture, the horizontal, continuous work which rests



Entablature of Tuscan Column.

upon a row of columns, and belongs especially to classical architecture. It consists of three principal divisions—the architrave immediately above the abacus of the column, next the frieze, and then the cornice. In large buildings projections similar to and known also as entablatures are often carried round the whole edifice, or along one front of it.

ENTAIL', in law, the settlement of an estate by which a freehold is limited to a person and the heirs of his body, with such particular restrictions as the donor may specify. Entailed estates are divided into general and special, the former when the estate is given to the donee and his heirs without exception, the latter when the estate is limited to certain heirs to the exclusion of others.

ENTENTE CORDIALE (äṅ'tänt' kôr'dyäl'). A term used specifically to signify a certain cordiality, based either on sentiment or on community of interests, between different countries and statesmen. It suggests a relation bordering on an alliance, though a formal alliance is by no means necessary to create it.

ENTER'IC FEVER. See Typhoid Fever.

ENTERI'TIS (Greek, enteron, intestine), inflammation of the intestines. There are several forms of the disease of great severity and very fatal. A common form, which is of the nature of an intestinal catarrh, generally yields to simple treatment; but other forms are of great danger, and demand skilled and attentive treatment.

ENTOMOL'OGY, the branch of zoology which treats of the insects. The true insects are those animals of the division Arthropoda or Articulata distinguished from the other classes of the division by the fact that the three divi-

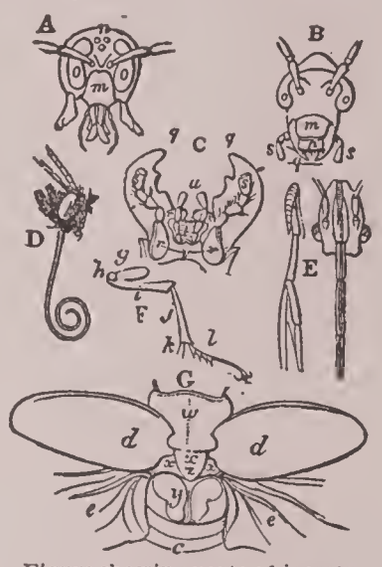


Figure showing parts of insects.

A, B, C, Mandibulate mouth. A, Head of Hornet, and upper side of mouth. *m*, Clypeus. *n*, Ocelli, stemmata, or simple eyes. *o*, Compound eyes. B, Head of beetle, and C, under side of mouth of beetle. *m*, Clydeus. *o*, Eyes. *p*, Labrum or upper lip. *q*, Mandibles or upper jaws. *r*, Maxillæ or lower jaws. *s*, Maxillary palpi. *t*, Labium or under lip. *u*, Labial palpi. *v*, Mentum or chin.—D and E, Haustellate mouths. D, Spiral sucker of a butterfly, called antlia. E, Straight sucker of a plant-bug (pentatoma) called haustellum.—F, Leg of stag-beetle. *g*, Coxa. *h*, Trochanter. *i*, Femur. *j*, Tibia *k*, Calcaria or spurs. *l*, Tarsus, which in this instance is pentamerous, or consisting of five pieces.—G, Thorax of stag-beetle. *c*, Abdomen. *d d*, Elytra. *e e*, Wings. *w*, Prothorax. *x*, Mesothorax. *y*, Metathorax. *z*, Scutellum.

sions of the body—the head, thorax, and abdomen—are always distinct from one another. There are never more than three pairs of legs in the perfect insect, and these are all borne upon the thorax. Each leg consists of from six to nine joints. The first of these is called the "coxa," and is succeeded by a short joint called the "trochanter." This is followed by a joint, often of large size, called the "femur," succeeded by the "tibia," and this has articulated to it the "tarsus," which may be composed of from one to five joints. Normally two pairs of wings are present, but one or other may be wanting. The wings are expansions of the sides of the second and third sections of the thorax, and are attached by slender tubes called "nervures." In the beetles the anterior pair of wings becomes hardened so as to form protective cases for the posterior membraneous wings, and are called in this condition "elytra" or "wing-cases." Respiration is effected by means of air-tubes or tracheæ, which commence at the surface of the body by lateral apertures called "stigmata" or "spiracles," and ramify through every part of the body. The head is composed of several segments amalgamated together, and carries a pair of feelers or "antennæ," a pair of eyes, usually compound, and the appendages of the mouth. The thorax is composed of three segments, also amalgamated, but generally pretty easily recognized. The abdominal segments are usually more or less freely movable upon one another, and never carry locomotive limbs; but the extremity is frequently furnished with appendages connected with generation, and which in some cases serve as offensive and defensive weapons (stings). The organs of the mouth take collectively two typical forms, the masticatory and the suctorial, the former exemplified by the beetles, the latter by the butterflies, in which the mouth is purely for suction. The alimentary canal consists of the œsophagus or gullet, a crop, a gizzard, a stomach, and an intestine, terminating in a cloaca. There is no regular system of blood-vessels; the most important organ of the circulation is a contractile vessel situated dorsally and called the "dorsal vessel." The nervous system is mainly composed of a series of ganglia placed along the ventral aspect of the body and connected by a set of double nerve-cords. The sexes are in different individuals, and most insects are oviparous. Reproduction is generally sexual, but non-sexual reproduction also occurs. Generally the young are very different from the full-grown insect, and pass through a "metamorphosis" before attaining the mature stage. When this metamorphosis is complete it exhibits three stages—that of the larva, caterpillar, or grub, that of the pupa or chrysalis, and that of the imago or perfect winged insect.

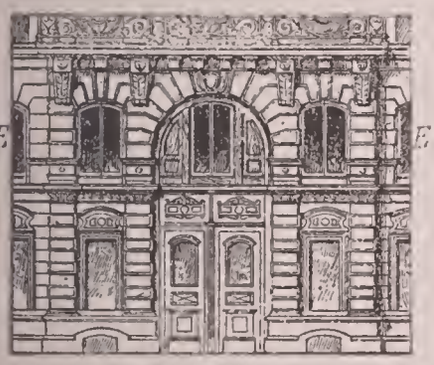
ENTOZO'A, a general name for those annulose parasitical animals, which infest the bodies of other animals. Some are found in the intestines, others in the liver, brain, muscles, and other tissues. They pass through different stages in their development, and at each stage occupy a different tissue and usually a different animal. Thus the cystic or bladder worm, whose presence in the brain of sheep causes staggers, is the immature form of the tapeworm of the dog, etc. The number of species is being reduced as the relations of the different forms are studied.

ENTREES (äṅ-trāz), in cookery, made dishes comprising cutlets, fricassees sweetbreads, and similar dishes, usually served hot before the joints at dinner.—

Entremets are similar dishes, but of a more delicate character, served between the main dishes of the second course at dinner.

ENTREPOT (äṇ-tr-pō; Fr.), a port where foreign merchandise which cannot enter the interior of a country is deposited in magazines under the surveillance of the custom-house officers till it is re-exported; also, any place where goods are sent to be distributed wherever customers are found.

ENTRE RIOS (en'trē rē'os; "between rivers"), a province of the Argentine Republic, lying between the Uruguay and the Paraná; area estimated at 45,000 sq. miles; pop. 300,000. The province is largely pastoral. Capital, Concepcion, with a pop. of 10,000.



Part of house on Boulevard Malesherbes, Paris. *E*, *E*, entresol.

ENTRESOL (en'tèr-sol;), a low story between two of greater height, generally the ground and first stories.

EN'TRY, in law, the act of taking possession of lands or tenements by entering or setting foot on the same.

EN'VELOPES, the paper covers that inclose letters or notes. They became common shortly after the introduction of the penny postal system; were at first made chiefly by hand, but are now not only shaped, but folded, gummed, etc., by machinery.

ENVIRONMENT, in zoölogy and botany, the sum of the conditions or surroundings of animal and plant life. Climate, the physical features of a country, absence or presence of enemies, and ease or difficulty of procuring food are among the more important factors of environment.

EN'VOY, a person deputed by a ruler or government to negotiate a treaty, or transact other business, with a foreign ruler or government. We usually apply the word to a public minister sent on a special occasion or for one particular purpose; hence an envoy is distinguished from an ambassador or permanent resident at a foreign court, and is of inferior rank.

E'OCENE, in geology, a term applied to the lower division of the Tertiary strata. The Eocene beds are arranged in two groups, termed the Lower and Upper Eocene; the strata formerly called Upper Eocene being now known as Oligocene. They consist of marls, limestones, clays, and sandstones, and are found in the Isle of Wight and in the southeast of England and northwest of France, in Central Europe, Western Asia, Northern Africa, and the Atlantic coast of North America.

EOLIAN HARP. See Æolian Harp.

EOLITH'IC PERIOD, in archæology, the early part of the palæolithic period of prehistoric time.

EOZO'IC ROCKS, the name given to the oldest fossiliferous rocks, such as the Laurentian and Huronian of Canada, from their being supposed to contain the first or earliest traces of life in the stratified systems.

EOZO'ON, a supposed gigantic fossil foraminifer found in the limestone of the Laurentian rocks of Canada, and in the Archæan rocks of Germany; so called as being the oldest form of life traceable in the past history of the globe. There is doubt, however, as to their being true fossils, many geologists now regarding them as of mineral origin.

EP'ACT, in chronology, the excess of the solar month above the lunar synodical month, and of the solar year above the lunar year of twelve synodical months. The epacts then are annual and menstrual or monthly. Suppose the new moon to be on the 1st of January: the month of January containing 31 days, and the lunar month only 29 days, 12 hours, 44 minutes, 3 seconds; the difference, 1 day, 11 hours, 15 minutes,57 seconds, is the menstrual epact. The annual epact is nearly 11 days; the solar year being 365 days, and the lunar year 354. The epacts were once of some importance in ecclesiastical chronology, being used for finding when Easter would fall.

EPARCH (ep'ärk), in Greece, the governor or prefect of a provincial division called an eparchy, a subdivision of a nomarchy or province of the kingdom. In Russia an eparchy is the diocese or arch-diocese of a bishop or archbishop.

EPAULEMENT (e-pāl'ment), in fortification, a term for the mass of earth or other material which protects the guns in a battery in front and on either flank.

EP'AULET, EP'AULETTE, an ornamental shoulder-piece belonging to a military or other dress. Epaulettes were worn in the British army till 1855, and are still worn in the navy by all officers of and above the rank of lieutenant, and by some civil officers.

EPHEM'ERA, are known as mayflies or day-flies, and are characterized by the slenderness of their bodies; the delicacy of their wings, which are erect and unequal, the anterior being much the larger; the rudimentary condition of the mouth; and the termination of the abdomen in three filiform appendages. In the state of larvæ and pupæ they are equatic and exist for years. When ready for their final change they creep out of the water, generally toward sunset of a fine summer evening, beginning to be seen generally in May. They shed their whole skin shortly after leaving the water, propagate their species, and die, taking no food in the perfect state. The may-fly is well known to anglers, who imitate it for bait.

EPHE'SIANS, The Epistle to the, a canonical epistle addressed by the apostle Paul to the church which he had founded at Ephesus. It was written during his first captivity at Rome, immediately after he had written the Epistle to the Colossians (A.D. 62); and was sent by the hands of Tychicus, who also bore the message to the church at Colossæ.

EPH'ESUS, an ancient Greek city of Lydia, in Asia Minor, one of the twelve Ionian cities, on the south side of the Caystrus, near its mouth. It was at one time the grand emporium of Western Asia, having a convenient and spacious harbor. The apostle Paul visited Ephesus and established a Christian church there, to which he dedicated one of his epistles. It was famous for its temple of Artemis (Diana), called Artemision, the largest and most perfect model of Ionic architecture, and reckoned one of the seven wonders of the world. The first great temple, begun about B.C. 650 and finished after 120 years, was burnt by the notorious Herostratus in order to perpetuate his name B.C. 356 (the night of Alexander the Great's birth). A second and more magnificent was then erected, which was burned by the Goths in A.D. 262. Some interesting remains have recently been discovered by excavation. Several church councils were held here, especially the third ecumenical council of 431, at which Nestorius was condemned. The site of the city is now desolate; near it is a poor village, Aiasoluk.

EPH'OD, a species of vestment worn by the Jewish high-priest over the second tunic. It consisted of two main pieces, one covering the back, the other the breast and upper part of the body, fastened together on the shoulders by two onyx stones set in gold, on each of which were engraved the names of six tribes according to their order. A girdle or band, of one piece with the ephod, fastened it to the body. Just above the girdle, in the middle of the ephod, and joined to it by little gold chains, rested the square breastplate with the Urim and Thummim. The ephod was originally intended to be worn by the high-priest exclusively, but a similar vestment of an inferior material seems to have been in common use in later times among the ordinary priests.

E'PHRAIM, the younger son of Joseph, and the founder of one of the twelve tribes of Israel. When the Israelites left Egypt the Ephraimites numbered 40,500, and their possessions in the very center of Palestine included most of what was afterwards called Samaria.

EP'IC, a poem of the narrative kind. Some authorities restrict the term to narrative poems written in a lofty style and describing the exploits of heroes. Others widen the definition so as to include not only long narrative poems of romantic or supernatural adventure, but also those of a historical, legendary, mock-heroic, or humorous character. Epic is distinguished from drama in so far as the author frequently speaks in his own person as narrator; and from lyrical poetry by making the predominant feature the narration of action rather than the expression of emotion. Among the more famous epics of the world's literature may be noted: Homer's Iliad and Odyssey; Virgil's Æneid; the German Nibelungenlied; the Anglo-Saxon poem of Beowulf; the French

Song of Roland; Dante's Divina Commedia; Tasso's Gierusalemme Liberata; Arosto's Orlando Furioso; Milton's Paradise Lost; Spenser's Fairy Queen; Camoens' Lusiads (Portuguese); and Firdusi's Shah Nameh (Persian). Hesiod's Theogony; the poetic Edda; the Finnish Kalewala; the Indian Mahâbhârata may be described as collections of epic legends. The historical epic has an excellent representative in Barbour's Bruce; and specimens of the mock-heroic and humorous epic are found in The Battle of the Frogs and Mice; Reynard the Fox; Butler's Hudibras; and Pope's Rape of the Lock.

EPICTE'TUS, a Greek Stoic philosopher, born in Phrygia about A.D. 60. He lived long at Rome, where, in his youth, he was a slave. Though nominally a Stoic, he was not interested in Stoicism as an intellectual system; he adopted its terminology and its moral doctrines, but in his discourses he appeared rather as a moral and religious teacher than as a philosopher. His doctrines approach more nearly to Christianity than those of any of the earlier Stoics, and although there is no trace in what is recorded of them of his having been directly acquainted with Christianity, it is at least probable that the ideas diffused by Christian teachers may have indirectly influenced them. The excellence of his system was universally acknowledged. When Domitian banished the philosophers from Rome (A.D. 94) Epictetus retired to Epirus. There he is supposed to have died. His disciple Arrian collected his opinions, which are preserved in two treatises called the Discourses of Epictetus, and the Manual or Enchiridion.

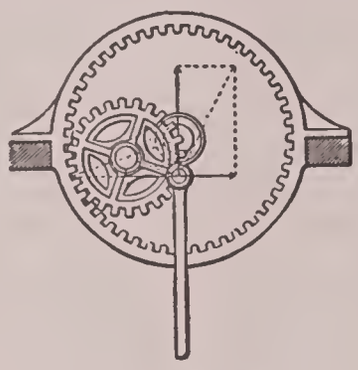
EPICURE'AN PHILOSOPHY. See Epicurus.

EPICU'RUS, a Greek philosopher, founder of the Epicurean school, was born in the island of Samos B.C. 342, died at Athens B.C. 270. He settled at Athens, B.C. 306, and purchased a garden in a favorable situation, where he established a philosophical school. Here he spent the remainder of his life, living in a simple manner and taking no part in public affairs. His pupils were numerous and enthusiastically devoted to him. His theory of the universe was based on the atomic theory of Democritus. The fundamental principle of his ethical system was that pleasure and pain are the chief good and evil, the attainment of the one and the avoidance of the other of which are to be regarded as the end of philosophy. He endeavored, however, to give a moral tendency to this doctrine. He exalted the pure and noble enjoyments derived from virtue, to which he attributed an imperishable existence, as incalculably superior to the passing pleasures which disturb the peace of mind, the highest good, and are therefore detrimental to happiness. Peace of mind, based on meditation, he considered as the origin of all good. The philosophy of Epicurus has been violently opposed and frequently misrepresented; but while it is not open to the charges of gross sensualism which have been brought against it, it cannot be considered as much better than a refinement of sensualism. In ancient times his philosophy appears to have been more popular in Greece than in Rome, although his disciples were numerous in both, and the Latin poem of Lucretius, De Rerum Natura, is a poetical exposition of his doctrines. Epicurus was a very voluminous writer, but few of his writings are extant, and what we possess comprising only some fragments of a Treatise on Nature, two letters, and detached passages. Lucretius, Cicero, Pliny, and Diogenes Laertius are our chief authorities for his doctrines.

EP'ICYCLE, in the ancient astronomy a small circle supposed to move round the circumference of a larger, a hypothetical mode of representing the apparent motion of the planets, which were supposed to have such a motion round the circumference of a large circle, called the deferent, having the earth in its center.

EPICY'CLOID, in geometry, a curve generated by the movement of a circle upon the convex side of another curve, that generated by the movement of a circle upon the concave side of a fixed curve being called a hypocycloid.

EPICYCLOI'DAL WHEEL, a wheel or ring fixed to a framework, toothed on its inner side, and having in gear with it another toothed wheel of half the diameter of the first, fitted so as to revolve



Epicycloidal wheel.

about the center of the latter. It is used for converting circular into alternate motion, or alternate into circular. While the revolution of the smaller wheel is taking place any point whatever on its circumference will describe a straight line, or will pass and repass through a diameter of the circle, once during each revolution. In practice, a piston-rod or other reciprocating part may he attached to any point on the circumference of the smaller wheel.

EPIDEM'IC, or EPIDEMIC DISEASE, signifies a disease which attacks a people, suddenly spreading from one to the other in all directions, prevailing a certain time and then dying away. It usually travels from place to place in the direction of the most-frequented lines of communication. The reason is that such diseases are commonly due to some infective material capable of being conveyed from one individual to another, and of being transported from place to place. In the U. S. small-pox and cholera are occasionally epidemic, while scarlet fever, measles, chicken-pox, diphtheria, typhoid fever, etc., are almost invariably so. Certain diseases which appear to be more mental than physical sometimes occur so numerously as to assume an epidemic form, such as St. Vitus' dance, convulsionary diseases, suicidal mania, etc. See Endemic.

EPIDER'MIS, in anatomy, the cuticle or scarf-skin of the body; a thin membrane covering the true skin of animals, consisting of two layers, an inner or mucous layer, called the rete mucosum, composed of active cells containing granules of coloring matter, and an outer or horny layer, consisting of flattened scale-like cells, dry, inactive, and effete which are constantly being shed in the form of dust. Both layers are destitute of feeling, and of vessels or nerves.—The term is also applied to the cellular layer which covers the surface of plants, usually formed of a layer or layers of more or less compressed and flattened cells. It may be thin and soft or dense and hard, and has often appendages in the form of hairs, glands, etc.

EPIGÆA (-jē'a), a genus of shrubs of the heath order, characterized by having three leaflets on the outside of the five-

Trailing arbutus.

parted calyx; and by the corolla being salver-shaped, five cleft, with its tube hairy on the inside. the trailing arbutus, is the May-flower of N. America.

EPIGASTRIUM, Epigastric Region, that part of the abodmen that lies over the stomach. See Abdomen.

EPIGLOTTIS, a cartilaginous plate behind the tongue, which covers the glottis like a lid during the act of swallowing, and thus prevents foreign bodies from entering the larynx. In its ordinary position during respiration it is pointed upwards, but in the act of swallowing it is pressed downwards and backward by the drawing up of the windpipe beneath the base of the tongue, and thus closes the entrance to the air-passages. See Larynx.

EP'IGRAM, in a restricted sense, a short poem or piece in verse, which has only one subject, and finishes by a witty or ingenious turn of thought; in a general sense, a pointed or witty and antithetical saying. The term was originally given by the Greeks to a poetical inscription placed upon a tomb or public monument, and was afterward extended to every little piece of verse expressing with precision a delicate or ingenious thought, as the pieces in the Greek anthology. In Roman classical poetry the term was somewhat indiscriminately used, but the epigrams o

Martial contain a great number with the modern epigrammatic character.

EP'ILEPSY, a nervous disease, the falling-sickness, so-called because the patient falls suddenly to the ground. It depends on various causes, often exceedingly complicated and incapable of being removed; hence it is often an incurable periodical disease, appearing in single paroxysms. In its fully-developed form, convulsions, attended by complete unconsciousness, are the prominent feature. Among the different causes may be mentioned hereditary tendency, gastric disturbances, or some irritation within the skull itself, such as tumors, etc. It is, for the most part, preceded by a tingling sensation, creeping up from the foot or hand to the breast and head, or some other premonitory symptom such as spectral illusions, headache, giddiness, confusion of thought, sense of fear, etc.; but sometimes there are no precursive symptoms. During the paroxysm all that is to be attended to is to prevent the patient from injuring himself; and this is to be accomplished by raising the head gently and loosening all tight parts of the dress. It is advisable to protect the tongue from being bitten by introducing a piece of india-rubber, cork, or soft wood between the teeth.

EP'ILOGUE, the closing speech or short poem addressed to the audience at the end of a play. The epilogue is the opposite of the prologue, or opening address.

EPINAY, Louise Florence Pétronille, Madame d', French authoress, born in 1725, died 1783. She became the wife of M. Delalive d'Epinay, who filled the office of farmer-general. In 1748 she became acquainted with Rousseau, and gave him a cottage in which he passed many of his days. She was the author of Les Conversations d'Emilie, Lettres à Mon Fils, and Mes Moments Heureux. She left interesting memoirs and correspondence.

EPIPH'ANY, a festival, otherwise called the manifestation of Christ to the Gentiles, observed on the 6th of January in honor of the adoration of our Savior by the three magi, or wise men, who came to adore him and bring him presents, led by the star. As a separate festival it dates from 813.

EPIS'COPACY, the system of church government in which bishops are established as distinct from and superior to priests or presbyters, there being in the church three distinct orders—deacons, priests, and bishops. See Bishop.

EPISCOPAL CHURCH, THE PROTESTANT, the religious body formerly known as "The Church of England in America," and generally styled the "American Episcopal Church." The full legal title of this communion is "The Protestant Episcopal Church in the United States of America," to distinguish it from those Christians, on the one hand, who acknowledge the papal supremacy, and from those, on the other who reject the authority of bishops. Whether this were really intended or not is perhaps doubtful; the name, however, describes with sufficient accuracy the relations of this church to the other religious bodies in the U. States.

The Episcopal Church is the descendant and representative of that branch of the Church of England which was established in the North American colonies in the 17th century. The English adventurers of that and the preceding age, like the Spaniards and Portuguese, carried their national religion with them, and introduced it wherever they gained a footing.

The first services of the Reformed Church of England within the territory now occupied by the U. States were held probably at Point Réyes, Drake's Bay, on the California coast, in June and July, 1579. Francis Fletcher, priest and preacher of the little company in the Golden Hind, in which Sir Francis Drake at this time circumnavigated the globe, records in the World Encompassed the use of the church's prayers on the eve, or on the festival, of St. John Baptist, June 24, at which service sailors and savages were the worshipers, and the crew of the Golden Hind besought their God in behalf of the natives attracted to these solemn rites that He would "open their blinded eyes to the knowledge of Him, and of Jesus Christ the salvation of the Gentiles."

EPISCOPAL SYSTEM, in the Roman Catholic Church, that theory according to which the highest clerical power is vested in the whole body of bishops. This theory was most prominently brought forward in the papal elections of the 14th century, and its followers declared the church, as represented in its general assemblies, to be above the pope. But the declaration of papal infallibility put an end to these differences, and made an impossibility of the episcopal system. In the German Protestant churches the episcopal system is that theory according to which the authority of the bishops, which had been suspended in the Protestant countries in consequence of the peace of 1555, was transferred to the ruler of the country.

EP'ISODE, an incidental narrative, or digression in a poem, which the poet has connected with the main plot, but which is not essential to it.

EP'ITAPH, an inscription upon a tomb or monument in honor or memory of the dead. Epitaphs were in use both among the Greeks and Romans. The Greeks distinguished by epitaphs only their illustrious men. Among the Romans they became a family institution and private names were regularly recorded upon tombstones. The same practice has generally prevailed in Christian countries. On Christian tombstone epitaphs usually give brief facts of the deceased's life, sometimes also the pious hopes of survivors in reference to the resurrection or other doctrines of the Christian faith, etc. Many so-called epitaphs are mere witty jeux d'esprit, which might be described as epigrams, and which were never intended seriously for monumental inscriptions. The literature of the subject is very large.

EPITHALAMIUM, a nuptial song or poem in praise of a bride and bridegroom. Among the Greeks and Romans it was sung by young men and maids at the door of the bridal chamber of a newmarried couple.

EPITHE'LIUM, in anatomy, the cellular layer which lines the internal cavities and canals of the body, both closed and open, as the mouth, nose, respiratory organs, blood-vessels, etc., and which is analogous to the cuticle of the outer surface. There are several varieties of epithelium. The epithelium lining the blood-vessels is called sometimes endothelium.

EPIZOOT'IC, or **EPIZOOTIC DISEASE,** a disease that at some particular time and place attacks great numbers of the lower animals just as an epidemic attacks man. Pleuro-pneumonia is often an epizootic, as was also the rinderpest.

E PLU'RIBUS U'NUM. The national motto of the United States, proposed by the committee appointed by Congress on July 4, 1776, to prepare designs for a seal. The intended meaning was "One formed of many," in reference to the composition of the government.

EPOCH, or **ERA,** is a fixed point of time, commonly selected on account of some remarkable event by which it has been distinguished, and which is made the beginning or determining point of a particular year from which all other years, whether preceding or ensuing, are computed. The creation and the birth of Christ are the most important of the historical epochs. The creation has formed the foundation of various chronologies, the chief of which are: 1. The epoch adopted by Bessuet, Ussher, and other Catholic and Protestant divines, which places the creation in B.C. 4004. 2. The Era of Constantinople (adopted by Russia), which places it in B.C. 5508. 3. The Era of Antioch, used till A.D. 284, placed the creation B.C. 5502. 4. The Era of Alexandria, which made the creation B.C. 5492. This is also the Abyssinian Era. 5. The Jewish Era, which places the creation in B.C. 3760. The Greeks computed their time by periods of four years, called Olympiads, from the occurrence every fourth year of the Olympic games. The first Olympiad, being the year in which Corœbus was victor in the Olympic games, was in the year B.C. 776. The Romans dated from the supposed era of the foundation of their city (Ab Urbe Condita, A.U.C.), the 21st of April, in the third year of the sixth Olympiad, or B.C. 753 (according to some authorities B.C. 752). The Christian Era, or mode of computing from the birth of Christ as a starting-point, was first introduced in the 6th century, and was generally adopted by the year 1000. This event is believed to have taken place earlier, perhaps by four years, than the received date. The Julian epoch, based on the coincidence of the solar, lunar, and indictional periods, is fixed at 4713 B.C., and is the only epoch established on an astronomical basis. The Mohammedan Era, or Hejĭra, commences on 16th July, 622, and the years are computed by lunar months. The Chinese reckon their time by cycles of 60 years. Instead of numbering them as we do, they give a different name to every year in the cycle. See Chronology, Calendar.

EPSOM SALT, sulphate of magnesium a cathartic salt which appears in capillary fibers or acicular crystals. It is found covering crevices of rocks, in mineral springs, etc.; but is commonly prepared by artificial processes from

magnesian limestone by treating it with sulphuric acid, or by dissolving the mineral kieserite in boiling water, allowing the insoluble matter to settle, and crystallizing out the Epsom salt from the clear solution. It is employed in medicine as a purgative, and in the arts. The name is derived from its having been first procured from the mineral waters at Epsom.

EQUATION, in algebra, a proposition asserting the equality of two quantities, and expressed by the sign = between them; or an expression of the same quantity in two dissimilar terms, but of equal value; as, $3s. = 36d.$ or $x = b + m - r$. In the latter case x is equal to b added to m with r subtracted, and the quantities on the right hand of the sign of equation are said to be the value of x on the left hand. An equation is termed simple, quadratic, cubic, or biquadratic, or of the first, second, third, or fourth degree, according as the index of the highest power of the unknown quantity is one, two, three, or four.

EQUATION, in astronomy, the correction or quantity to be added to or subtracted from the mean position of a heavenly body to obtain the true position. The term personal equation is the quantity of time by which a person is in the habit of noting a phenomenon wrongly; it may be called positive or negative, according as he notes it after or before it really takes place.

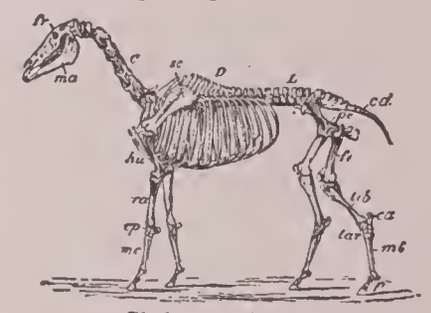
EQUATION OF TIME, the difference between mean and apparent time, or the difference of time as given by a clock and as given by a sun-dial, arising chiefly from the varying velocity of the earth in its orbit and the eccentricity of the orbit. The sun and the clock agree four times in the year; the greatest difference between them at the beginning of November is fully sixteen minutes. See Day.

EQUATION, PERSONAL, the constant which must be applied to every time observation recorded by an observer (as in astronomy) in order to make the mean of such observations agree with those of another observer. It is found by experience that different persons, in recording the results of observations will make various errors, some anticipating the event, but others failing to record it at the proper time. When it is found possible, by examining a long series of records made of the same event by two observers, to discover the average difference between their records of events, a very important correction of time-intervals may sometimes be introduced into a computation based upon such records. Such a correction is called the relative personal equation of the two astronomers. When it is found that an observer habitually makes, or is likely to make, a certain error in his time-records, such error (or absolute personal equation) can be readily allowed for.

EQUA'TOR, that great circle of our globe every point of which is 90° from the poles. All places which are on it have invariably equal days and nights. Our earth is divided by it into the northern and southern hemispheres. From this circle is reckoned the latitudes of places both north and south. There is also a corresponding celestial equator in the plane of the terrestrial, an imaginary great circle in the heavens the plane of which is perpendicular to the axis of the earth. It is everywhere 90° distant from the celestial poles, which coincide with the extremities of the earth's axis, supposed to be produced to meet the heavens. During his apparent yearly course the sun is twice in the celestial, and vertically over the terrestrial equator, at the beginning of spring and of autumn. Then the day and night are equal all over the earth, whence the name equinox.—The magnetic equator is a line which pretty nearly coincides with the geographical equator, and at every point of which the vertical component of the earth's magnetic attraction is zero; that is to say, a dipping needle carried along the magnetic equator remains horizontal. It is hence also called the aclinic line.

EQUATO'RIAL, an astronomical instrument contrived for the purpose of directing a telescope upon any celestial object, and of keeping the object in view for any length of time, notwithstanding the diurnal motion of the earth. For these purposes a principal axis resting on firm supports is mounted exactly parallel to the axis of the earth's rotation, and consequently pointing to the poles of the heavens, being fixed so as to turn on pivots at its extremities. To this there is attached a telescope moving on an axis of its own in such a way that it may either be exactly parallel to the other axis, or at any angle to it; when at right angles it points to the celestial equator. By this means a star can be followed by one motion from its rising to its setting. In some observatories the equatorials have the necessary motion given them by clock-work.

EQUESTRIAN STATUE, a complete figure of a person on horseback, executed generally in bronze or stone. In ancient Greece, where plastic art attained its highest perfection, statues of



Skeleton of horse.

fr, frontal bone; *C*, cervical vertebræ; *D*, dorsal vertebræ; *L*, lumbar vertebræ: *cd*, caudal vertebræ; *sc*, scapula; *pe*, pelvis; *ma*, mandible; *hu*, humerus; *ra*, radius; *cp*, carpus; *mc*, metacarpus; *fe*, femur; *tib*, tibia; *ca*, calcaneum; *tar*, tarsus; *mt*, metatarsus; *p*, phalanges.

men and horses were often of the first excellence, but horses were more commonly represented as attached to the chariot. In Rome, equestrian statues of the emperors were common.

EQ'UIDÆ, the horse family, a family belonging to the order Ungulata, or hoofed mammals, and subdivision perissodactyla, characterized by an undivided hoof formed of the third toe and its enlarged horny nail, a simple stomach, a mane on the neck, and by six incisor teeth on each jaw, seven molars on either side of both jaws, and by two small canine teeth in the upper jaw of the males, and sometimes in both jaws. It is divided into two groups—one including the asses and zebras, the other comprising the true horses.

EQUILIB'RIUM, a state of equipoise; a state of rest produced by the mutual counteraction of two or more forces, as the state of the two ends of a lever or balance, when both are charged with equal weight. When a body, being slightly moved out of any position, always tends to return to its position, that position is said to be one of stable equilibrium; when the body will not thus return to its previous position, its position is said to be one of unstable equilibrium.

EQUINOC'TIAL, in astronomy, the circle in the heavens otherwise known as the celestial equator. When the sun is on the equator there is equal length of day and night over all the earth: hence the name equinoctial.—Equinoctial gales, storms which are observed generally to take place about the time of the sun's crossing the equator, that is, at the vernal and autumnal equinox, in March and September. (See Equinox.)—Equinoctial points are the two points wherein the celestial equator and ecliptic intersect each other; the one, being in the first point of Aries, is called the vernal point; and the other, in the first point of Libra, the autumnal point. These points are found to be moving backward or westward at the rate of 50″ of a degree in a year. This is called the precession of the equinoxes.

EQ'UINOX, the precise time when the sun enters one of the equinoctial points, or the first point of Aries about the 21st of March, and the first point of Libra about the 23d of September, making the day and night of equal length all over the world. At all other times the length of the day and of the night are unequal, their difference being the greater, the more we approach either pole, while in the same latitude it is everywhere the same.

EQ'UITY, in law, the system of supplemental law administered in certain courts, founded upon defined rules, recorded precedents, and established principles, the judges, however, liberally expounding and developing them to meet new exigencies. While it aims to assist the defects of the common law, by extending relief to those rights of property which the strict law does not recognize and by giving more ample and distributive redress than the ordinary tribunals afford, equity by no means either controls, mitigates, or supercedes the common law, but rather guides itself by its analogies, and does not assume any power to subvert its doctrines. Courts of equity grant redress to all parties where they have right, and modify any fashion that redress according to circumstances. They bring before them all the parties interested in the subject-matter of the suit, and adjust the rights of all.

EQUITY OF REDEMPTION, in law the advantage allowed to a mortgagor of a reasonable time to redeem an estate mortgaged, when it is of greater value than the sum for which it is mortgaged.

EQUIV'ALENTS, in chemistry, a term for the proportions in which the elements

combine with one another to form compounds. See Chemistry.

ERA. See Epoch.

ERAS'MUS, Desiderius, a Dutch scholar, born at Rotterdam in 1467. His original name was Gerard, but this he changed according to a fashion of the time. In 1492 he traveled to Paris to perfect himself in theology and polite literature. He went to England in 1497, where he was graciously received by the king. He returned soon after to the Continent, and took his doctor's degree. He returned to England in 1510; wrote his Praise of Folly and was appointed Margaret professor of divinity and Greek lecturer at Cambridge. In 1514 he returned to the Continent and lived chiefly at Basel, where he died in 1536. To extensive learning Erasmus joined a refined taste and a delicate wit. He rendered great and lasting service to the cause of reviving scholarship. Although he took no direct part in the Reformation, and was reproached by Luther for lukewarmness, he attacked the disorders of monasticism and superstition, and everywhere promoted the cause of truth.

Desiderius Erasmus.

le edited various classics, the first edi- ion of the Greek Testament from MSS. with Latin translation), etc., but his est-known books are the Encomium loriæ, or Praise of Folly, and his Col- quies.

ER'EBUS, in the Greek mythology, ie son of Chaos and Darkness. The ame Erebus was also given to the in- rnal regions.

ER'FURT, an important town in the russian province of Saxony, on the ver Gera, formerly a fortress with two tadels, now given up as such. Pop. ,360.

ER'GOT, the altered seed of rye and her grasses caused by the attack of a ngus. The seed is replaced by a dense mogeneous tissue largely charged th an oily fluid. In its perfect state is germinates and produces the Clavi- os. When diseased rye of this kind is en in food for some time it sometimes uses death by a kind of mortification led dry gangrene. Ergot is used in stetric practice to promote the con- ction of the uterus.

ERICA (e-rī'ka), the heath, a large ius of branched rigid shrubs, most of ich are natives of South Africa, a few ng found in Europe and Asia. The leaves are narrow and rigid, the flowers are globose or tubular, and four-lobed.

1, Heads of ergot (*aa*) produced on a grass. 2, Clavideps purpurea (*bb*) springing from the Ergot.

ER'ICSSON, John, engineer, born in Sweden, 1803. He served for a time in the Swedish army; removed to London in 1826, and to New York in 1839. He is identified with numerous inventions

John Ericsson.

and improvements on steam machinery and its applications. His chief inventions are his caloric engine, the screw propeller (1836), which has revolutionized navigation, and his turret-ships, the first of which, the Monitor, distinguished itself in the American civil war, and inaugurated a new era in naval warfare. He latterly devoted himself to studies of the earth's motion and the intensity of solar heat. He died in 1889.

ERIE (ē'ri), one of the great chain of North American lakes, between Lakes Huron and Ontario, about 265 miles long, 63½ miles broad at its center, from 40 to 60 fathoms deep at the deepest part; area 9600 square miles. The whole of its southern shore is within the territory of the U. States, and its northern within that of Canada. It receives the waters of the upper lakes by Detroit river at its southwestern extremity, and discharges its waters into Lake Ontario by the Niagara river at its northeast end. The Welland Canal enables vessels to pass from it to Lake Ontario. It is shallow compared with the other lakes of the series, and is subject to violent storms. The principal harbors are those on the U. States side—Buffalo, Erie, Cleveland, etc.

ERIE, a city in Pennsylvania; an important railway and commerical center on the southern shore of Lake Erie. There are numerous iron-works (including foundries, rolling-mills, blast-furnaces, etc.), petroleum refineries, breweries, tanneries, wood-working factories, etc. The harbor is one of the best on the lake. Population, 1909, 68,000.

ERIE CANAL, the largest in the U. States, serving to connect the great lakes with the sea. It begins at Buffalo on Lake Erie, and extends to the Hudson at Albany. It is 363 miles long; has in all 72 locks; a surface width 70 feet, bottom width 42 feet, and depth 7 feet It is carried over several large streams on stone aqueducts; cost nearly $10,000,000, and was opened in 1825. The navigation is free.

ERIODEN'DROL, the wool-tree. There are eight species natives of America, but one belongs to Asia and Africa. The species are noble plants,

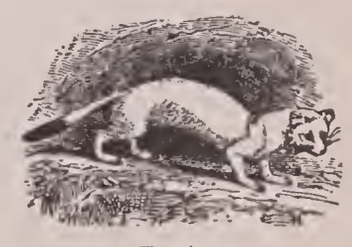
Wool-tree.

growing from 50 to 100 feet high, having palmate leaves, and red or white flowers. The woolly coat of the seeds of some of the species is used in different countries for stuffing cushions and similar purposes.

ERIOM'ETER, an optical instrument for measuring the diameters of minute particles and fibers, from the size of the colored rings produced by the diffraction of the light in which the objects are viewed.

ER'IVAN, a Russian town, capital of government of the same name in the lieutenancy of the Caucasus, on the Sanga, north of Mount Ararat. It has a citadel, barracks, a cannon foundry, and some manufactures. Pop. 12,505. The government has an area of 10,705 sq. miles, and a pop. of 583,957.

ER'MINE, the stoat, a quadruped of the weasel tribe, found over temperate Europe, but common only in the north. In consequence of the change that occurs in the color of its fur at different seasons—by far most marked in the



Ermine.

Arctic regions—it is not generally known that the ermine and stoat are the same. In winter, in cold countries or severe seasons, the fur changes from a reddish-

Ermine.

brown to a yellowish-white, or almost pure white, under which shade the animal is recognized as the ermine. In both states the tip of the tail is black. Like many other species of this genus

the ermine has the faculty of ejecting a fluid of a musky odor. Its fur is short, soft, and silky. It was formerly one of the insignia of royalty, and is still used by judges. When used as linings of cloaks the black tuft from the tail is sewed to the skin at irregular distances.—In heraldry, ermine is one of the furs, represented with its peculiar spots black on a white ground.

E'ROS, the Greek name of Cupid and Amor.

EROSION THEORY, in geology, the theory, now held by all geologists, that valleys are due to the wearing influences of water and ice, the latter chiefly in the form of glaciers, as opposed to the theory which regards them as the result of fissures in the earth's crust produced by strains during its upheaval.

EROT'IC, relating to love.—Erotic Poetry, amatory poetry.—The name of erotic writers has been applied, in Greek literature, particularly to a class of romance writers, and to the writer of the Milesian Tales.

ERRA'TA, the list of errors and corrections placed at the end or at the beginning of a book.

ERRAT'ICS, or **ERRATIC BLOCKS,** in geology, boulders or large masses of angular rock which have been transported to a distance from their original mountains by the action of ice during the glacial period. Thus on the slopes of the Jura Mountains immense blocks of granite are found which have traveled 60 miles from their original situation. Similarly masses of Scotch and Lake-district granites and of Welsh rocks (some of which weigh several tons) occur not uncommonly in the surface soil of the Midland counties of England.

ERROR, WRIT OF, in law, a formal instrument, issued by or under authority of a court, commanding the person to whom it is addressed to do a certain act therein specified. It is written in the form of a mandate from the highest authority in the state—the king in Great Britain, the president, people, or commonwealth in the United States, attested by the chief judge of the court, sealed and signed by the clerk, and may be issued either at the commencement of an action or proceeding, or during its progress, to the sheriff or to some other person, for the purpose of procuring various acts to be done in connection with such action or proceeding.

ERSKINE, Thomas, Lord Erskine, Scottish lawyer, the youngest son of the tenth earl of Buchan, was born in 1750, and died in 1823. After serving four years in the navy and seven in the army he commenced the study of law, and in 1778 took his degree at Cambridge and was called to the bar. His success was immediate. In May, 1783, he was elected a member of parliament for Portsmouth, a seat he held till 1806, when he was raised to the peerage. The rights of juries he firmly maintained on all occasions. In 1792, being employed to defend Thomas Paine, when prosecuted for the second part of his Rights of Man, he declared that, waiving all personal convictions, he deemed it right, as an English advocate, to obey the call; by the maintenance of which principle he lost his office of attorney-general to the Prince of Wales. In the trials of Hardy, Tooke, and others for high treason in 1794, the ability displayed by Erskine was acknowledged by all parties. He was a warm partisan of Fox, and a strenuous opposer of the war with France. On the death of Pitt, in 1806, Erskine was created a peer, and raised to the dignity of lord-chancellor. During his short tenure of office the bill for the abolition of slavery was passed.

ERUPTIVE ROCKS, in geology, those which, like lava, basalt, granite, etc., have broken through other rocks while in a molten state.

ERYSIP'ELAS, the rose, or St. Anthony's fire, a disease characterized by diffused inflammation of the skin or some part of the body, but chiefly of the face or head, and attended by fever. It is, generally, an acute affection, its medium duration being from ten to fourteen days. It should be treated by nourishing food and iron tonics, the parts being protected from cold.

ERYTHE'MA, a mild form of inflammation of the skin somewhat resembling erysipelas. Some forms are connected with constitutional diseases, as rheumatism, gout, etc.

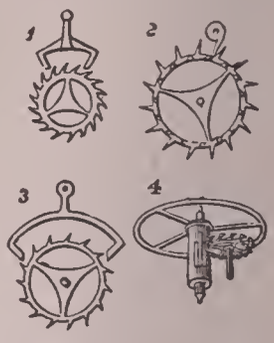
ERZERUM, ERZEROUM, or **ERZEROOM** (er'ze-röm), a city of Turkish Armenia, capital of a vilayet with an area of 27,000 sq. miles, and a pop. of 582,745. The town is about 6000 feet above sea-level, forms an important strategical center, and has become a principal frontier fortress. The Moslem element prevails largely over the Christian, although it is the metropolis of the Armenian church in union with Rome. In addition to important manufactures, especially in copper and iron, it carries on an extensive trade, and is a chief halting-place for Persian pilgrims on their way to Mecca. Pop. 38,894.

ESARHAD'DON, the son of Sennacherib, and one of the most powerful of all the Assyrian monarchs. He extended the empire on all sides, and is the only Assyrian monarch who actually reigned at Babylon. He died about 667 B.C.

E'SAU, the eldest son of Isaac, and twin-brother of Jacob. His name (which signifies rough, hairy) was due to his singular appearance at birth, being "red, and all over like an hairy garment." The story of his marriage, of his loss of birthright through the craft of Rebekah and Jacob, and of his quarrel and reconciliation with Jacob, are told in the book of Genesis. He was the progenitor of the Edomites, who dwelt on Mount Seir.

ESCANABA, the capital of Delta co., Mich., situated on the C. and N. W. Railway and on Green Bay, 360 miles north of Chicago. It ships annually over 4,000,000 tons of iron ore and large quantities of coal, lumber, and fish. Pop. 10,760.

ESCAPE'MENT, the general contrivance in a time-piece by which the pressure of the wheels (which move always in one direction) and the vibratory motion of the pendulum or balance-wheel are accommodated the one to the other. By this contrivance the wheel-work is made to communicate an impulse to the regulating power (which in a clock is the pendulum and in a watch the balance-wheel), so as to restore to it the small portion of force which it loses in every vibration, in consequence of friction and the resistance of the air. The leading requisite of a good escapement is that the impulse communicated to the



Watch and clock escapements.
1, Anchor escapement of a common clock. 2, Duplex escapement. 3, Lever escapement. 4, Horizontal or cylinder escapement.

pendulum or balance-wheel shall be invariable, notwithstanding any irregularity of foulness in the train of wheels. Various kinds of escapements have been contrived, some of which are shown in the accompanying figure. See also Clock, Watch.

ESCHATOL'OGY (es-ka-), in theol. the "doctrine respecting the last things," which treats of the millennium, the second advent of Christ, the resurrection, judgment, conflagration of the world, and the final state of the dead.

ESCHEAT (es-chēt'), in law, a species of reversion arising from default of heirs or by forfeiture. That which falls or lapses to the original proprietor, or to the state, as lands or other property. By modern legislation there can be no escheat on failure of the whole blood wherever there are persons of the half blood capable of inheriting.

ESCROW', a legal writing delivered to a third person to be delivered by him to the person whom it purports to benefit, when some condition is performed. Upon the performance of this condition it becomes an absolute deed, but if the condition be not performed it remains a escrow or scroll.

ESCU'RIAL, a remarkable building in Spain, comprising at once a palace, convent, a church, and a mausoleum. It is distant from Madrid about 24 miles in a northwesterly direction, and situated on the acclivity of the Sierra Guadarrama, the range of mountains which divides New from Old Castile. It was built by Philip II., and dedicated to St. Lawrence, in commemoration of the victory of St. Quentin, fought on the festival of the saint in 1557. It is popularly considered to be built on the plan of a gridiron, from the fact that St. Lawrence is said to have been broiled alive on a sort of large gridiron. The building is a rectangular parallelogram measuring 744 feet in length by 580 in breadth. The interior is divided into courts, formerly inhabited by monks and ecclesiastics, while a projection 300 feet in length (the handle of the gridiron) contains the royal palace. It was begun in 1563 and finished in 1584. It is of moderate height, and its innumerable windows (said to be 11,000) give it (apart from the church) somewhat the

aspect of a large mill or barracks. The church is the finest portion of the whole building. The dome is 60 feet in diameter, and its height at the center is about 320 feet. Under it is the Pantheon or family vault of the Spanish sovereigns. The library contains a valuable collection, including a rich store of Arabic MSS. The Escurial was partly burned in 1671, when many MSS. were destroyed, and was pillaged by the French in 1808 and 1813. It was restored by Ferdinand VII., but the monks, with their revenues which supported it, have long since disappeared. In 1872 it was fired by lighting, and suffered serious damage.

ESCUTCHEON, in heraldry, the shield whereon coats of arms are represented. See Heraldry.

ESDRAE'LON, Plain of, a plain extending across Palestine from the Mediterranean to the Jordan, and drained by the river Kishon. Among its subsidiary valleys are those of Engannin, Taanach, and Megiddo. This plain is celebrated for many important events in Old Testament history.

ESDRAS, Books of, two apocryphal books, which, in the Vulgate and other editions, are incorporated with the canonical books of Scripture. In the Vulgate the canonical books of Ezra and Nehemiah are called the first and second and the aprocryphal books the third and fourth books of Esdras. The Geneva Bible (1560) first adopted the present nomenclature, calling the two aprocyphal books first and second Esdras. The subject of the first book of Esdras is the same as that of Ezra and Nehemiah, and in general it appears to be copied from the canonical Scriptures. The second book of Esdras is supposed to have been either of much later date, or to have been interpolated by Christian writers.

ES'KIMOS. See Esquimaux.

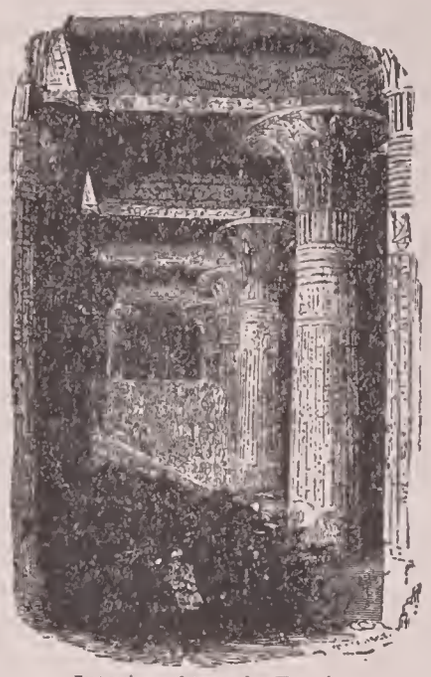
ESMARCH (es'märh), Johannes Friedrich August, German surgeon; born 1823. He held high official positions during the Schleswig-Holstein and Franco-German wars; is a great authority on gun-shot wounds; has originated valuable improvements in barrack-hospitals, ambulances, etc.; and is the author of several surgical works.

ES'NEH, a town of Upper Egypt, on the left bank of the Nile, 28 miles s.s.w. of Thebes, capital of a province of same name, on the site of the ancient Latopolis. Among the ruins there is a beautiful portico of twenty-four lofty and massive columns, belonging to a temple of Kneph (the only portion of the temple cleared out), and erected in the Ptolemaic and Roman period, with a zodiac on the ceiling. Esneh is the entrepôt of the Senaar caravans; has manufactures of cottons, pottery, etc.; and is reckoned the healthiest place in Egypt. Pop. 7000.

ESOP. See Æsop.

ESPERANTO LANGUAGE. An effort to establish an international language. In 1887 Dr. Zamenhof, a Russian physician, issued a pamphlet suggesting a new international language, to be called Esperanto. Only trifling progress was made in the first ten years of the movement. The famous French linguist, M. de Beaufort threw his own scheme aside and accepted that of Dr. Zamenhof as better suited for the purpose intended. From France the movement extended to Germany, Austria, Switzerland, Italy, and England. During the last few years active work has been undertaken in the U. States. Books on the Esperanto language are now printed in more than twenty languages and the number of periodicals is estimated at 30. At the Bologne congress, delegates from 22 countries spoke the language freely.

The Esperanto vocabulary is much smaller than any other language, having only about 2,000 words as compared to 32,000 in the French and 100,000 words in the English languages.



Interior of temple, Esneh.

ESPIR'ITO-SANTO ("Holy Spirit"), a maritime province, Brazil, bounded north by Bahia, south by Rio-de-Janeiro, length, about 260 miles; breadth, about 120 miles; area, 43,290 sq. miles. Pop. 121,560.

ESPLANADE', in fortification, the wide open space left between a citadel and the nearest houses of the city. The term is also frequently applied to a kind of terrace, especially along the sea-side, for public walks or drives.

ESPOU'SAL or BETROTHAL, consists of a deliberate mutual promise of marriage, expressed by outward signs, between two persons, both of whom may lawfully and validly enter into such an engagement. When such promise is made and accepted on both sides, neither party can lawfully withdraw from it without the other's consent or unless something comes to light, which, had it been known in time, would have prevented the engagement.

ESQUIMAULT (es-kē'mâlt), a harbor and naval station on the southeast coast of Vancouver Island, about 3 miles from Victoria, the capital of British Columbia. The harbor is almost landlocked, and with the "Royal Roads" outside, is capable of giving safe anchorage to a fleet of vessels of the largest size. It is the station of H.M. ships on the Pacific coast, and is being fortified and provided with all the necessaries of a first-class naval arsenal.

ESQUIMAUX (es'ki-mōz), or **ESKIMOS,** a race inhabiting the Arctic coasts of North America, from Greenland to Bering's Strait, and extending into Asia. They call themselves Inu-it, the people; their other name is from an Algonquin word signifying eaters of raw flesh. They consist of three principal stocks—the Greenlanders; the Esquimaux proper, in Labrador; and the western Esquimaux, found along Hudson's Bay, the west side of Baffin's Bay, the polar shores as far as the mouths of the Coppermine and Mackenzie rivers, and both on the American and Asiatic sides of Bering's Strait. Their leading physical peculiarities are a stunted stature, flattened nose, projecting cheek-bones, eyes often oblique, and yellow and brownish skin. Seal-skins, reindeer and other furs are used as materials for dress, according to the season, as well as skins of otters, foxes, martins, etc. In summer they live in tents, covered with skins; in winter they may be said to burrow beneath the snow. In Greenland houses built of stone and cemented with turf are used as permanent habitations. Vegetation being extremely stunted within the limits of their territories, their food consists of the flesh of whales, seals, walrus, etc., often eaten raw; and they show remarkable skill in fishing and hunting. Their weapons are bows and arrows, spears or lances, generally pointed with bone, but sometimes with metal. Their only domestic animal is the Esquimaux dog (which see). In intellect they are by no means deficient; in manners they are kind and hospitable. Their religious ideas appear scanty, but success has attended the labors of the Danish missionaries in teaching them the Christian religion.

ESQUIMAUX DOG, or **ESKIMO DOG,** a breed of dogs extensively spread over the northern regions of America and of eastern Asia. It is rather larger than the English pointer, but appears less on account of the shortness of its legs. It has oblique eyes, an elongated muzzle, and a bushy tail, which give it a wolfish appearance. The color is generally a deep dun, obscurely barred and patched with darker color. It is the only beast of burden in these latitudes, and with a team of such dogs attached to his sledge the Eskimo will cover 60 miles a day for several successive days.

ES'SAY, a composition in which something is attempted to be proved or illustrated, usually shorter and less methodical and finished than a systematic or formal treatise; so that it may be a short disquisition on a subject of taste, philosophy, or common life. Caution or modesty has induced many writers of note to give the title of essay to their most elaborate productions; thus we have Locke's Essay on the Human Understanding.

ESSEN, a town of Rhenish Prussia, 18 miles northeast of Düsseldorf, founded in the 9th century, and adorned with a fine church dating from 873. It has recently increased with great rapidity and is celebrated for the steel and iron works of Krupp, the most extensive in Europe, employing about 20,000 workmen. Pop. 78,706.

ESSENCES, solutions of the volatile or essential oils in spirits.

ESSENES (es-sēnz'), or **ESSÆANS,** a sect among the Jews, the origin of which is unknown, as well as the etymology of their name. It appears to have sprung up in the course of the century preceding the Christian era, and disappeared on the dispersion of the Jews after the siege of Jerusalem. The sect appears to have been an outcome of Jewish mysticism, which gradually assumed the form of a distinct organization. They were remarkable for their strictness and abstinence, and had a rule of life analogous to that of a monastic order.

ESSENTIAL OILS, volatile oils usually drawn from aromatic plants by subjecting them to distillation with water, such as the oils of lavender, cloves, peppermint, etc.

ESSEX, a maritime county in the s.e. of England, bounded by Suffolk, the Thames, Hertford, and Middlesex; area is 987,032 acres. The surface is generally level, except in the n.w., where it is undulating and sometimes hilly. The soil is in general extremely fertile. The principal productions are potatoes, barley, wheat, oats, mangolds, turnips, tares, rape, mustard, and trefoil. The raising of caraway, coriander, and teaze, is almost peculiar to this county. The chief towns are Chelmsford, the county town; West Ham, Colchester, Maldon, and Harwich. The county has eight parliamentary divisions, each returning one member. Pop. 785,399.

ESSEX, Robert Devereux, Second Earl of, was born in 1567. Having appeared at court, he soon became a favorite of Queen Elizabeth, by whom he was kept in attendance against his will during the danger of the Armada. He served with more or less distinction in expeditions to Portugal and France, the latter on behalf of Henry of Navarre. In 1596 he was commander of the troops in an expedition against Spain, and distinguished himself by the capture of Cadiz. In an expedition next year he was less fortunate, and the queen, with whom he was always quarreling, received him coldly. Presuming on the favor of Elizabeth he behaved with rudeness to her at a privy-council and received a box on the ear, and was told to "go and be hanged." After some months a reconciliation took place, and he was appointed Lord-lieutenant of Ireland (1599), which was then in a state of rebellion. He returned to England in September, having been entirely unsuccessful in his government. He was made a prisoner in his own house, and foolishly tried to excite an insurrection in London. After a skirmish with a party of soldiers he was compelled to surrender, and sent to the Tower. He was tried for treason on 19th February, and executed on 26th February, 1601.

ESTABLISHED CHURCH, a church having a form of doctrine and government established by law in any country for the teaching of Christianity within its boundaries, and usually endowed by the state. The upholders of the establishment theory maintain that it is the duty of a state to provide for the religious instruction of the people. On the other hand, it is argued that the state has no right to endow or support any particular sect or denomination, unless they assume that that denomination alone is possessed of religious truth and worth.

ESTATE, the interest or quantity of interest a man has in lands, tenements, or other effects. Estates are real or personal. Real estate comprises lands, tenements, and hereditaments, held in freehold. Personal estate comprises interests for term sofy ears in lands, tenements and hereditaments, and property of every other description. Real estate descends to heirs; personal to executors or administrators. In ordinary language, an estate is a piece of landed property; a definite portion of land in the ownership of some one.

ESTHER, a Jewess, who became the queen of Ahasuerus, King of Persia, and whose story is told in the book of the Old Testament called by her name. This book is supposed by some to be the composition of Mordecai himself, the uncle of the heroine. Various opinions are held regarding the time and truth of the story; but the feast of Purim which commemorates the events narrated is still observed by the Jews during the month Adar.

ESTHONIA, a maritime government of Russia, bounded by the gulf of Finland, the Baltic, and the governments of Livonia and St. Petersburg. It includes several islands, of which the most important are Dagoe and Oesel; area, about 7610 sq. miles. The peasantry are almost all of Finnish origin, and speak a Finnish dialect. In the 10th and 12th centuries it belonged to Denmark, it was afterward annexed by Sweden, and in 1710 was seized by Russia. Revel is the capital. Pop. 392,738.

ESTOP'PEL, in law, anything done by a party himself, which puts a period to an action by closing the ground of controversy.

ESTREMADU'RA, a western division of Spain, consisting of the provinces of Badajoz and Caceres. The area is about 16,700 sq. miles, and the pop. 818,211.

ESTREMADURA, a maritime province of Portugal. The principal city is Lisbon. Area, 6876 sq. miles. Pop. 946,472.

ES'TUARY, the wide mouth of a river opening out so as to form an arm of the sea.

ETA'WAH, a town, Hindustan, N. W. Provinces, capital of the district of same name, on left bank of the Jumna, picturesqnely situated among ravines, and richly planted with trees. Pop. 34,721. The district has an area of 1694 sq. miles, and a pop. of 722,371.

ETCHING, the art of producing designs upon a plate of steel or copper by means of lines drawn with an etching-needle (a fine-pointed steel tool), the lines being drawn through a coating or varnish (the ground), and bitten in by some strong acid which can only affect the plate where the varnish has been removed.

ETHELBERT, King of England, son of Ethelwulf, succeeded to the government of the eastern side of the kingdom in 857, and in 860, on the death of his brother Ethelbald, became sole king. He died in 866.

ETH'ELBERT, King of Kent, born about 560, died 616. He succeeded his father, Hermenric, and reduced all the Anglo-Saxon states, except Northumberland, to the condition of his dependants. Ethelbert was the first Anglo-Saxon king to draw up a code of laws.

ETH'ELRED I., King of England, son of Ethelwulf, succeeded his brother Ethelbert in 866. Ethelred died in consequence of a wound received in an action with the Danes in 871, and was succeeded by his brother Alfred.

ETHELRED II., King of England, son of Edgar, born 968, succeeded his brother, Edward the Martyr, in 978, and, for his want of vigor and capacity, was surnamed the Unready. He died at London in the midst of his struggle with Canute (1016).

ETH'ELWULF, King of England, succeeded his father, Egbert, about 837; died 857. He is best remembered for his donation to the clergy, which is often quoted as the origin of the system of tithes.

E'THER, a hypothetical medium of extreme tenuity and elasticity supposed to be diffused throughout all space (as well as among the molecules of which solid bodies are composed), and to be the medium of the transmission of light and heat.

ETHER, in chem. a very light, volatile and inflammable fluid, produced by the distillation of alcohol with sulphuric acid. It is lighter than alcohol, of a strong, sweet smell, susceptible of great expansion, and has a pungent taste. A mixture of vapor of ether with atmospheric air is extremely explosive. Ether produces an intoxication of short duration, and is sometimes used as an anæsthetic.

ETH'ICS, otherwise called Moral Philosophy or Morals, is the science which treats of the nature and laws of the actions of intelligent beings, considered as to whether they are right or wrong, good or bad. The science is more or less closely connected with theology, psychology, politics, political economy, and jurisprudence, but what most strictly belongs to it is the investigation of the principles and basis of duty or the moral law, and an inquiry into the nature and origin of the faculty by which duty is recognized. Various answers have been given to the question why we call an action good or bad, such as that it is consistent or not with the will of God, or with the nature of things, or with the greatest happiness of the greatest number, or that an inward faculty decides it to be such or such; and a great variety of ethical systems have been proposed. The foundations of the leading systems were laid in antiquity, the names of Socrates, Plato, Aristotle, Epicurus, the Cynics and the Stoics being especially prominent. The introduction of Christianity brought a new element into ethical speculation, and among Christians ethics were intimately associated with theology, and morality was regarded as based on and regulated by a definite code contained in the sacred writings. The speculations of the Greeks were not, however, disregarded, and some of the ablest Christian moralists (as Augustine, Peter Lombard, Erigena, Anselm, Aquinas, etc.) endeavored to harmonize the Greek theories with the Christian dogmatics.

Most modern ethical systems consider the subject as apart from theology and as based on independent philosophical principles, and they fall into one of two great classes—the utilitarian systems, which recognize as the chief good, happiness, or the greatest possible satisfaction of the tendencies of our nature; and the rationalistic systems, which recognize that ideas of law and obligation can have their source only in reason. The first of the modern school in England was Hobbes (1588–1679). Among subsequent names are those of Cudworth, Locke, Clarke, Shaftesbury, Butler, Hutchison, Hume, Adam Smith, Reid, Paley, Whewell, Bentham, J. S. Mill, etc. Among those who maintain the utilitarian theory of morals is Paley, who holds that men ought to act so as to further the greatest possible happiness of the race, because God wills the happiness of men, and rewards and punishes them according to their actions, the divine commands being ascertained from Scripture and the light of nature. Bentham's utilitarianism is considerably different from Paley's. It was entirely dissociated from theology or Scripture, and maintained that increase of happiness ought to be the sole object of the moralist and legislator, pleasure and pain being the sole test of actions. To utilitarianism as a special development belong the later "evolution ethics" represented by Mr. Herbert Spencer, in which biological conceptions, such as "the preservation of the human race," take the place of the Benthamite criterion for determining what is good and bad in actions. Another theory of ethics places the moral principal in the sentimental part of our nature, that is, in the direct sympathetic pleasure or sympathetic indignation we have with the impulses which prompt to action or expression. By means of this theory, which he treats as an original and inexplicable fact in human nature, Adam Smith explains all the phenomena of the moral consciousness. In considering the systems which recognize that the ideas of law and obligation can have their source only in reason, the question, what is the source of the laws by which reason governs, gives rise to a number of psychological theories among which we may notice Clarke's view of the moral principles as rational intuitions or axioms analogous to those of mathematics; Butler's theory of the natural authority of conscience; the position of Reid, Stewart, and other members of the later intuitional school, who conceive a moral faculty implanted in man which not only perceives the "rightness" or "moral obligation" of actions, but also impels the will to perform what is seen to be right. Very similar as far as classification goes, is the position of Kant, who holds that reason recognizes the immediate obligation of certain kinds of conduct, and that an action is only good when done from a good motive, and that this motive must be essentially different from a natural inclination of any kind.

ETHIOPIA, or **ÆTHIOPIA** (Hebrew, Cush), in ancient geography, the country lying to the south of Egypt, and comprehending the modern Nubia, Kordofan, Abyssinia, and other adjacent districts; but its limits were not clearly defined. In ancient times its history was closely connected with that of Egypt, and about the 8th century B.C. it imposed a dynasty on Lower Egypt, and acquired a predominant influence in the valley of the Nile. In sacred history Ethiopia is repeatedly mentioned as a powerful military kingdom (see particularly Isaiah xx. 5). In the 6th century B.C. the Persian Cambyses invaded Ethiopia; but the country maintained its independence till it became tributary to the Romans in the reign of Augustus. Subsequently Ethiopia came to be the designation of the country now known as Abyssinia, and the Abyssinian monarchs still call themselves rulers of Ethiopia.

ETHNOL'OGY AND ETHNOG'RAPHY, sciences treating of man, the former analyzing the social phenomena of mankind as shown in their customs, languages, institution, etc.; the latter being more concerned with descriptive details and the orderly collection of facts relating to particular tribes and localities. Besides these terms there is the term Anthropology, used by some to indicate the general science or natural history of mankind, of which the other two are parts. Here we can only give a few particulars bearing on the strictly ethnological and ethnographic divisions of the subject. (As to the place of man in the animal kingdom see Man.) The unity or plurality of species of the human race is a question which has given rise to much discussion. The most common view has probably been that which regards all mankind as descended from Adam and Eve, attributing the great differences exhibited by different races to climate and other causes acting for a long period of time. Many have held that such differences were not to be so accounted for and that the various typical races of the earth were not descended from a single pair, but were separately created in separate localities. The belief that man may have originated from a single pair is supported by the researches of Darwin, who has shown how an accumulation of differences amounting to the appearance of a distinct species may arise from continual modifications of a single primordial form. Certainly among men the variability of the same race under different climatic conditions is very striking. Even within a comparatively small period of time physical surroundings have induced typical differences between the lithe, sparsely-fleshed Yankee of New England and the plump, rosy-cheeked Englishman; and the Boer of South Africa, with its dry climate, has developed a type as decidedly different from his original stock in moist Holland. The theory of the development of the human race from a single species demands a vast duration of time; and the flint implements discovered intermingled with remains of the mammoth and other extinct animals have proved that man was a contemporary of the mammoth, the cave bear, and other mammalia of the geological period antecedent to our own, though how distant that period was as measured by thousands of years it is difficult to say. Another interesting point is in regard to the first home of the human race. This of course is quite uncertain, but probably it was either in western Asia or in Africa, and we may naturally conclude that where the mammalia of the highest characteristics appear there was the possible birthplace and center of distribution of mankind.

When we attempt to classify mankind we can scarcely find any one physical characteristic belonging exclusively to a single race. At most we can only say that certain characteristics are the preponderant ones in certain races. In seeking racial characteristics ethnologists make use of various principles of classification. Some give the first place to the shape of the head. Camper, the Dutch anatomist, was the first who attempted to make a scientific distinction of races on this principle, taking as the basis of measurement the amount of the facial angle. But Camper's method, though it illustrates excellently the great differences which exist, between, say, the anthropoid apes with an angle of 42°, the African negro with an angle of 70°, and the European with an angle of 80°, is without certainty, it being possible to find in the population of a single large town as wide variations of the facial angle as exist between distinct races. Camper's method was therefore superseded by the method of Blumenbach, which is based on consideration of all the chief distinctions in shape of the head according to which he classified the human family into five varieties: the Caucasian, Mongolian, Ethiopian, Malay and American. These five varieties were cut down to three by Cuvier, who treated the Malay and American as subdivisions of the Mongolian; and extended by Dr. Prichard, who divided the Caucasian class into a Semitic and an Aryan or Indo-European class. Latham's classification was into 1. Mongolidæ (Chinese, Turks, Malays, American races etc.); 2. Atlantidæ (African races, Jew and Arabs); 3. Japetidæ (Indo-Europeans). Among the later attempts made to find a new principle of classification we may mention that of Retzius, based on the relative length and breadth of the skull, according to which mankind are divided into Dolichocephalic or long-skulled and Brachycephalic or short, broad-skulled races. Later developments of craniology have introduced a third class, the Mesocephailic, representing a mean between the other two. The general rule for measurement is that the longitudinal diameter being rated as 100, the lateral diameter is expressed in a percentage of these units. If the index of breadth is from 74 to 78 the skull is termed mesocephalous; if below 74 it is dolichocephalous, a narrow or long skull; if it reaches 79 it is brachycephalous, a broad or short skull. The capacity of the brain cavity is also a favorite method with some ethnologists. Here the European stands highest with 92·1 cubic inches; the Australian lowest with 81·7. The character of hair and color of skin has always been used by Huxley as the basis of his classifications, which divides mankind into 1. Ulotrichi, crisp or woolly haired people with yellow or black skin, comprising Negroes, Bushmen, and Malays; 2. Leiotrichi, smooth-haired people, subdivided into Australioid, Mongoloid, Xanthochroic (fair

whites) and Melanochroic (dark whites) groups. But many ethnologists hesitate to accept a classification which brings together nations apparently unrelated, such as the Australians, the ancient Egyptians, and the tribes of southern India. On the other hand, the character of the hair is found to be one of the surest tests in separating neighboring races, such as the Papuan, and the Malayan and Australian tribes. Oscar Peschel's classification, based on a number of different particulars, such as the shape of the skull, the color of the skin, the nature and color of the hair, the shape of the features, etc., is as follows:

1. The Australians.—Characters: skull of the dolichocephalic type, the jaws being also prognathous or protruded. The nose is narrow at the root, widening greatly below. The mouth is wide and unshapely. The body is thickly covered with hair; the hair is black, elliptical in section, that on the head being frizzly, and standing out so as to form a shaggy crown. The color of the skin is dark as a rule, sometimes black, though a light copper-red also occurs.

2. The Papuans.—This race, which is the one most closely allied to the Australians, occupies New Guinea, New Caledonia, the Solomon Islands, New Hebrides, the Fiji Islands, etc. The most distinctive mark is their peculiarly flattened and abundant hair, growing in tufts, and forming a spreading crown round the head. The skin is always dark, the skull high and narrow (dolichocephalic); the jaws prognathous; the lips fleshy and somewhat swollen; the nose hooked somewhat after the Jewish type.

3. The Mongoloid Nations.—To this race belong the Polynesian and Asiatic Malays, the people of southeastern and eastern Asia, the Tibetese, all the Northern Asiatics, with their kinsmen in northern Europe, and lastly the aboriginal population of America. The common characteristics are: long straight hair, circular in section; almost complete absence of beard and body hair; skin dark-colored, varying from leather-yellow to deep brown, sometimes inclining to red; prominent cheek-bones, and eyes in general set obliquely. The various members of the Mongoloid race may be classed under the following subdivisions: (a) The Malay race, comprising the Malays of Malacca, Sumatra, Java, etc., the inhabitants of Madagascar, the New Zealanders, the natives of the Sandwich Islands, etc. (b) Southern Asiatics with monosyllabic languages, comprising the Chinese, Indo-Chinese (Burmese, Siamese, Anames, etc.), Tibetese, etc. (c) Coreans and Japanese. (d) Northern Mongoloids of the Old World, comprising the true Mongols, Turks, Finns, Lapps, Magyars, Bulgarians, etc., all much resembling the Chinese and Indo-Chinese group in physical characters. (e) Northern Nations of doubtful position.—The Yenisei Ostiakas, the Ainos of Yesso, the inhabitants of Saghalien, etc. (f) The Behring's Nations, of which the Esquimaux or Eskimo, are the most important. (g) The American Aborigines or Red Indian.

4. The Dravidians or Aborigines of India.—These tribes have the skin generally very dark, frequently quite black; their hair is long and black, not straight but crimped or curly; the hair of beard and body grows profusely; the lips are thick and fleshy, somewhat like those of the negroes, but the jaws are never prominent. The Dravidians comprise the Tamuls, Telugus, Gonds, Santals or Sonthals, etc.

5. The Hottentots and Bushmen.—These are tribes of little importance inhabiting South Africa. They have the hair tufted and matted, the beard scanty, the body almost hairless; the lips are full but not so much so as with the negroes; the nose is of the snub shape; the opening of the eyes is narrow but not oblique. They are slimly built, and the Bushmen are particularly low in stature; their color is yellowish or yellowish-brown.

6. The Negroes.—The negroes inhabit Africa from the southern margin of the Sahara to the territory of the Hottentots and Bushmen, and from the Atlantic to the Indian Ocean. They display great variety in external characteristics, and what is popularly considered the typical negro is rarely met with. The color of the skin passes through every graduation, from ebony-black to dark brown, copper-red, olive, or yellow. In some tribes the nose is straight, in others hooked, though often broad and flat. The hair of the head is generally short, elliptic in section, and much crimped; that on the body is not plentiful; whiskers are comparatively rare. The negroes may be divided into the Bantu negroes (including the Kaffirs, Bechuanas, etc.) and the Soudan negroes, these divisions being based on differences in language. It is in the Soudan region that the most typical members of the negro race are found.

7. The Mediterranean Nations.—These include all Europeans who are not Mongoloids, the north Africans, all western Asiatics, and the Hindus. Among them are the highest members of the human race. The northern nations have the skin quite fair; the southern have it darker; in North Africa and eastern Asia it becomes yellow, red, or brown. The nose has always a high bridge; prognathism and prominence of the jaws and cheek-bones are rare; the lips are never intumescent, and in no other race are refined and noble features so frequent. Subdivisions are: (a) The Hamites, comprising the ancient Egyptians, the Copts of Egypt and the Nubians, the Berbers and Gallas. (b) The Semites.—These comprise the Jews, Arabs, and Abyssinians, and the ancient Canaanites, Assyrians, Babylonians, and Phœnicians. (c) The Indo-European or Aryan family.—This family is divided into two branches, a European and an Asiatic. The European comprises the Germanic or Teutonic nations (English, Germans, Dutch, Danes, Norwegians, Swedes, etc.), the Romance nations (French, Italians, Spaniards, Portuguese), the Slavonians (Russians, Bohemians, Servians, etc.), the Greeks, and lastly the Celts. The Asiatic comprises the Hindus, Afghans, Persians, Armenians, and Kurds. (d) Europeans of doubtful position.—These include the Basques of the northeast of Spain and southwest of France and various tribes in the Caucasus.

ETH'YL, is the name given to the radicle which is contained in ether and alcohol. It is a colorless gas, which is liquefied by moderate cold and pressure, and which burns with a brilliant white flame.

ETH'YLAMINE, an organic base formed by the substitution of ethyl for all or part of the hydrogen of ammonia. It has the odor and many of the reactions of ammonia.

ETIENNE (ā-ti-ān), St., a town of southern France, dep. Loire, on the Furens, 32 miles s.w. of Lyons. The town stands in the center of one of the most valuable mineral fields of France; and in addition to the extensive collieries, blast-furnaces, and other ironworks in the vicinity, has manufactures of ribbons, silks, cutlery, firearms, etc. The collieries alone employ about 16,000 men. Pop. 1891, 133,443.

ETIQUETTE (et'i-ket), a collective term for the established ceremonies and usages of society, from the forms which are to be observed in particular places such as courts, levees, and public occasions, to the general forms of polite society. Among courts the Byzantine and Spanish courts, and the French court under Louis XIV. and XV., have been noted for the strictness of their etiquette. Social etiquette consists in so many minute observances that a tolerable familiarity with it can be acquired only by a considerable intercourse with polite society. It is often said that all that is necessary to constitute good social manners is common sense and good feeling; but not to mention those formal rules of society which, though intrinsically worthless, demand a certain amount of respect, there are also many difficulties and emergencies in social intercourse which require peculiar tact and delicacy of judgment. Hence quickness of sympathy and a certain fineness of observation are more needed for proficiency in this sphere than pure power of intellect.

ETNA, or Ætna Mount, the greatest volcano in Europe, a mountain in the province of Catania in Sicily; height 10,374 feet. It rises immediately from the sea, has a circumference of more

Etna.

than 100 miles, and dominates the whole northeast part of Sicily, having a number of towns and villages on its lower slopes. The top is covered with perpetual snow, midway down is the woody or forest region; at the foot is a region of orchards, vineyards, olive groves, etc. Etna thus presents the variety of cli-

mates common to high mountains in lower latitudes, oranges and lemons and other fruits growing at the foot, the vine rather higher up, then oaks, chestnuts, beeches, and pines, while on the loftiest or desert region vegetation is of quite a stunted character. A more or less distinct margin of cliff separates the mountain proper from the surrounding plain; and the whole mass seems formed of a series of superimposed mountains, the terminal volcano being surrounded by a number of cones, all of volcanic origin, and nearly 100 of which are of considerable size. The different aspects of the mountain present an astonishing variety of features—woods, forests, pastures, cultivated fields, bare rocky precipices, streams of lava, masses of ashes and scoriæ, as also picturesque towns and villages. From the summit the view presents a splendid panorama, embracing the whole of Sicily, the Lipari Islands, Malta, and Calabria. The eruptions of Etna have been numerous, and many of them destructive. That of 1169 overwhelmed Catania and buried 15,000 persons in the ruins. In 1669 the lava spread over the country for forty days, and 10,000 persons are estimated to have perished. In 1693 there was an earthquake during the eruption, when over 60,000 lives were lost. One eruption was in 1755, the year of the Lisbon earthquake. Among more recent eruptions are those of 1832, 1865, 1874, 1879. An eruption is ordinarily preceded by premonitory symptoms of longer or shorter duration.

ETRU'RIA, the name anciently given to that part of Italy which corresponded partly with the modern Tuscany, and was bounded by the Mediterranean, the Apennines, the river Magra, and the Tiber. The name of Tusci or Etrusci was used by the Romans to designate the race of people anciently inhabiting this country, but the name by which they called themselves was Rasena (or perhaps more correctly Ta-rasena). These Rasena entered Italy at a very early period from the north, and besides occupying Etruria proper, extended their influence to Campania, Elba, and Corsica. Etruria proper was in a flourishing condition before the foundation of Rome, 753 B.C. It was known very early as a confederation of twelve great cities, each of which formed a republic of itself. Among the chief were Veii, Clusium, Volsinii, Arretium, Cortona, Falerii, and Faesulae; but the list may have varied at different epochs. The chiefs of these republics were styled lucumones, and united the office of priest and general. They were elected for life. After a long struggle with Rome the Etruscan power was completely broken by the Romans in a series of victories, from the fall of Veii in 376 B.C. to the battle at the Vadimonian Lake (283 B.C.). The Etruscans had attained a high state of civilization. They carried on a flourishing commerce, and at one time were powerful at sea. They were less warlike than most of the nations around them, and had the custom of hiring mercenaries for their armies. Of the Etruscan language little is known, although more than 3000 inscriptions have been preserved. It was written in characters essentially the same as the ancient Greek; but philologists have not as yet been able to decide with what language it is connected, nor to agree in the decipherment of almost any inscription. The Etruscans were specially distinguished by their religious institutions and ceremonies, which reveal tendencies gloomy and mystical. Their gods were of two orders, the first nameless, mysterious deities, exercising a controlling influence in the background on the lower order of gods, who manage the affairs of the world. At the head of these is a diety resembling the Roman Jupiter (in Etruscan Tinia). But it is characteristic of the Etruscan religion that there is also a Vejovis or evil Jupiter. The Etruscan name of Venus was Turan, of Vulcan Sethlans, of Bacchus Phuphluns, of Mercury Turms. Etruscan art was in the main borrowed from Greece. For articles in terra-cotta, a material which they used mainly for ornamental tiles, sarcophagi, and statues Etruscans were especially celebrated. In the manufacture of pottery they had made great advances; but most of the painted vases popularly known as Etruscan are undoubtedly productions of Greek workmen. The skill of the Etruscans in works of metal is attested by ancient writers, and also by numerous extant specimens, such as necklaces, ear-rings, bracelets, etc. The bronze candelabra, of which many examples have been preserved, were eagerly sought after both in Greece and Rome. A peculiar manufacture was that of engraved

Etruscan sarcophagus in terra-cotta, from Chiusi; period of full development.—Museo Egizio, Florence.

bronze mirrors. These were polished on one side, and have on the other an engraved design, taken in most cases from Greek legend or mythology. The Etruscans showed great constructive and engineering skill. They were acquainted with the principle of the arch, and the massive ruins of the walls of their ancient cities still testify to the solidity of their constructions. Various arts and inventions were derived by the Romans from the Etruscans.

ETRUSCAN LANGUAGE. See Etruria.

ETRUSCAN VASES, a class of beautiful ancient painted vases made in Etruria, but not strictly speaking a product of Etruscan art, since they were really the productions of a ripe age of Greek art, the workmanship, subjects, style, and inscriptions being all Greek. They are elegant in form and enriched with bands of beautiful foliage and other ornaments, figures and similar subjects of a highly artistic character. One class has black figures and ornaments on a red ground—the natural color of the clay; another has the figures left of the natural color and the ground painted black. The former class belong to a date about 600 B.C., the latter date about a century

Etruscan vases.

later, and extend over a period of about 300 or 350 years, when the manufacture seems to have ceased. During this period there was much variety in the form and ornamentation, gold and other colors besides the primitive ones of black and red being frequently made use of. The subjects represented upon these vases frequently relate to heroic personages of the Greek mythology, but many scenes of an ordinary and even of a domestic character are depicted. The figures are usually in profile; temples are occasionally introduced; and many curious particulars may be learned from these vase pictures regarding the Hellenic ritual, games, festivities, and domestic life.

ETYMOL'OGY, a term applied (1) to that part of grammar which treats of the various inflections and modifications of words and shows how they are formed from simple roots; (2) to that branch of philology which traces the history of words from their origin to their latest form and meaning. Etymology in this latter sense, or the investigation of the origin and growth of words, is among the oldest of studies. Plato and other Greek philosophers, the Alexandrian grammarians, the scholiasts, the Roman Varro, and others wrote much on this subject. But their work is made up of conjectures at best ingenious rather than sound, and very often wild and fantastic. It was not till recent times, and particularly since the study of Sanskrit, that etymology has been scientifically studied. Languages then began to be properly classed in groups and families, and words were studied by a comparison of their growth and relationship in different languages. It was recognized that the development of language is not an arbitrary or accidental matter, but proceeds according to general laws. The result was a great advance in etymological knowledge and the formation of a new science of philology.

EUBŒ'A, formerly called Negropont, a Greek island, the second largest island of the Ægean Sea. It is 90 miles in length; 30 in greatest breadth, reduced at one point to 4 miles. The island was anciently divided among seven independent cities, the most important of which were Chalcis and Eretria, and its history is for the most part identical with that of those two cities. With some small islands it forms a modern nomarchy, with a pop. of 95,136.

EUCALYP'TUS, a genus of trees, mostly natives of Australia, and remarkable for their gigantic size, some of

them attaining the height of 480 or 500 feet. In the Australian colonies they are known by the name of gum-trees, from the gum which exudes from their trunks; and some of them have also such names as "stringy bark," "iron bark," etc. The wood is excellent for ship-

Blue gum-tree.

building and such purposes. The blue gum yields an essential oil which is valuable as a febrifuge, antiasthmatic, and antispasmodic; the medicinal properties of this tree also make it useful as a disinfectant, and as an astringent in affections of the respiratory passages, being employed in the form of an infusion, a decoction, or an extract, and cigarettes made of the leaves being also smoked. Two species have an excellent sanitary effect when planted in malarious districts such as the Roman Campagna, parts of which have already been reclaimed by their use. This result is partly brought about by the drainage of the soil (the trees absorbing great quantities of moisture), partly perhaps by the balsamic odor given out. The Eucalyptus has been introduced with success into India, Algiers, southern France, etc.

EUCHARIST (ū'ka-rist), a name for the sacrament of the Lord's supper, in reference to the blessing and thanksgiving which accompany it. See Lord's Supper.

EUCHRE (ū'kėr), a game of cards, played mostly by two of four persons. After cutting for the deal, five cards are dealt (either by twos and threes or by threes and twos) to each player. The uppermost card of those undealt is turned for trump. The first player has the option either to "order up" (i.e. to make this card trump) or "pass." In the latter case it is left to the next player to decide if he will play first or pass, and so on till the turn of the dealer comes, who must either play on this trump or turn it down, when all the players have again their choice in turn of making a new trump or passing. If a trump is "ordered up" or taken in the first round, the dealer may take it into his cards, discarding instead his poorest card. If the player who elects to play wins five tricks, he counts two; if he wins three tricks he counts one; if he wins fewer than three tricks he is euchred, and each independent opponent counts two. The cards rank as at whist, except that the knave of the trump suit, called the right bower (from Ger. bauer, a peasant), is the highest card, and the knave of the other suit of the same color the second highest.

EUCLID, of Alexandria, a distinguished Greek mathematician, who flourished about 300 B.C. His Elements of Geometry in thirteen books, are still extant, and form the most usual introduction to the study of geometry. The severity and accuracy of his methods of demonstration have as a whole never been surpassed. Besides the Elements, some other works are attributed to Euclid.

EUGENE (ū-jēn'), or **FRANCOIS EUGENE,** Prince of Savoy, fifth son of Eugéne Maurice, duke of Savoy-Carignan, and Olympia Mancini, a niece of Cardinal Mazarin, was born at Paris, Oct. 18, 1663. He entered the Austrian service in 1683, serving his first campaign as a volunteer against the Turks. On the outbreak of war between France and Austria he received the command of the imperial forces sent to Piedmont to act in conjunction with the troops of the Duke of Savoy. At the end of the war he was sent as commander-in-chief to Hungary, where he defeated the Turks at the battle of Zenta (Sept. 11, 1697).

Prince Eugene.

The Spanish war of succession brought Eugene again into the field. In northern Italy he outmaneuvered Catinat and Villeroi, defeating the latter at Cremona (1702). In 1703 he commanded the imperial army in Germany, and in cooperation with Marlborough frustrated the plans of France and her allies. In the battle of Höchstadt or Blenheim, Eugene and Marlborough defeated the French and Bavarians under Marshal Tallard, Aug. 13, 1704. Next year Eugene, returning to Italy, forced the French to raise the siege of Turin, and in one month drove them out of Italy. During the following years he fought on the Rhine, took Lille, and, in conjunction with Marlborough, defeated the French at Oudenarde (1708), and Malplaquet (1709), where he himself was dangerously wounded. In the war with Turkey, in 1716, Eugene defeated two superior armies at Peterwaradin and Temesvar, and, in 1717, took Belgrade, after having gained a decisive victory over a third army that came to its relief. He died in Vienna April 21, 1736. He was one of the great generals of modern times.

EUGENIE (eu-zhā-nē), Marie de Guzman, Ex-empress of the French, born at Granada in Spain in 1826. On Jan. 29, 1853, she became the wife of Napoleon III. and empress of the French. On March 16, 1856, a son was born of the marriage. When the war broke out with Germany she was appointed regent (July 27, 1870) during the absence of the emperor, but on the 4th Sept. the revolution forced her to flee from France. She went to England, where she was joined by the prince imperial and afterward by the emperor. On Jan. 9, 1873, the emperor died, and six years later the prince imperial was slain while with the English army in the Zulu war. In 1881 the empress transferred her residence to Farnborough in Hampshire.

EU'NUCH, a male of the human species emasculated by castration. The term is of Greek origin; but eunuchs became known to the Greeks no doubt from the practice among Eastern nations of having them as guardians of their women's apartments. Eunuchs were employed in somewhat similar duties among the Romans in the luxurious times of the empire, and under the Byzantine monarchs they were common. The Mohammedans still have them about their harems. Emasculation, when effected in early life, produces singular changes in males and assimilates them in some respects to women, causing them in particular to have the voice of a female. Hence, not so long ago, it was not uncommon in Italy to castrate boys in order to fit them for soprano singers when grown to manhood.

EUPHRA'TES, or **EL FRAT,** a celebrated river of western Asia, in Asiatic Turkey, having a double source in two streams rising in the Anti-Taurus range. Its total length is about 1750 miles, and the area of its basin 260,000 sq. miles. It flows mainly in a southeasterly course through the great alluvial plains of Babylonia and Chaldæa till it falls into the Persian Gulf by several mouths, of which only one in Persian territory is navigable. About 100 miles from its mouth it is joined by the Tigris, when the united streams take the name of Shatt-el-Arab. It is navigable for about 1200 miles, but navigation is somewhat impeded by rapids and shallows. The melting of snow in the Taurus and Anti-Taurus causes a flooding in spring. The water is highest in May and June, when the current, which rarely exceeds 3 miles an hour, rises to 5.

EURA'SIANS, a name sometimes given to the "half-castes" of India, the offspring of European fathers and Indian mothers. They are particularly common in the three presidential capitals—Calcutta, Madras, and Bombay. They generally receive a European education, and the young men are often engaged in government or mercantile offices. The girls in spite of their dark tint are generally very pretty and often marry Europeans.

EURE (eur), a river of n.w. France, which rises in the department of the Orne, and falls into the Seine after a course of 124 miles, being navigable for about half the distance. It gives its name to a department in the n.w. of France, forming part of Normandy; area, 2300 sq. miles. Evreux is the capital. Pop. 349,471.

EURE-ET-LOIR (eur-ė-lwär), a department in the n.w. of France, forming part of the old provinces of Orléannais

EUROPE
Moss

EUROPE

ENGLISH STATUTE MILES 0 100 200 300 400 500

KILOMETERS 0 100 200 300 400 500 600 700 800

Hammond's 8 x 11 Map of Europe.
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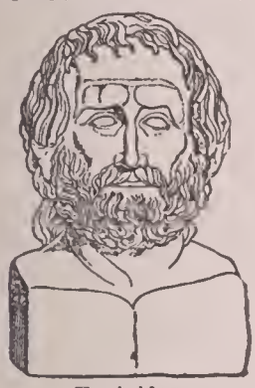
and Ile-de-France; area, 2267 sq. miles. The department is essentially agricultural, and has few manufactures. The capital is Chartres. Pop. 284,683.

EURE'KA, (I have found it), the exclamation of Archimedes when, after long study, he discovered a method of detecting the amount of alloy in King Hiero's crown. Hence the word is used as an expression of triumph, as a discovery.

EURIP'IDES (-dēz), a celebrated Athenian tragedian, born B.C. 480, or, according to the Arundel marbles, 485, at Salamis. He began to write tragedies at the age of eighteen, although his first published play, the Peliades, appeared



Euripides.

only in 455 B.C. He was not successful in gaining the first prize till the year 441 B.C., and he continued to exhibit till 408 B.C., when he exhibited the Orestes. The violence of unscrupulous enemies, who accused him of impiety and unbelief in the gods, drove Euripides to take refuge at the court of Archelaus, king of Macedonia, where he was held in the highest honor. According to a tradition he was killed by hounds in 406 B.C. Euripides is a master of tragic situations and pathos, and shows much knowledge of human nature and skill in grouping characters, but his works lack the artistic completeness and the sublime earnestness that characterize Æschylus and Sophocles. Euripides is said to have composed seventy-five, or according to another authority ninety-two tragedies. Of these eighteen (or nineteen, including the Rhesus) are extant, viz.: Alcestis, Medea, Hippolytus, Hecuba, Heracleidæ Supplices, Ion, Hercules, Furens, Andromache, Troades, Electra, Helena, Iphigenia in Tauris, Orestes, Phœnissæ, Bacchæ, Iphigenia in Aulis, and Cyclops.

EURIPUS (ū-rī'pus), in ancient geography, the strait between the island of Eubœa and Bœotia in Greece.

EURO'PA, in Greek mythology, the daughter of Agēnor, king of the Phœnicians, and the sister of Cadmus. The fable relates that she was abducted by Jupiter, who for that occasion had assumed the form of a bull, and swam with his prize to the island of Crete. Here Europa bore to him Minos, Sarpēdon, and Rhadamanthus.

EUROPE, the smallest of the great continents, but the most important in the history of civilization for the last two thousand years. It forms a huge peninsula projecting from Asia, and is bounded on the n. by the Arctic Ocean; on the w. by the Atlantic Ocean; on the s. by the Mediterranean, the Black Sea, and the Caucasus range; on the east by the Caspian Sea, the Ural river, and the Ural mountains. The most northerly point on the mainland is Cape Nordkyn, in Lapland, in lat. 71° 6′; the most southerly points are Punta da Tarifa, lat. 36° n., in the Strait of Gibraltar, and Cape Matapan, lat. 36° 17′, which terminates Greece. The most westerly point is Cape Roca in Portugal, in lon. 9° 28′, w., while Ekaterinburg is in lon. 60° 36′ e. From Cape Matapan to North Cape is a direct distance of 2400 miles, from Cape St. Vincent to Ekaterinburg, northeast by east, 3400 miles; area of the continent, about 3,800,000 sq. miles. Great Britain and Ireland, Iceland, Nova Zembla, Corsica, Sardinia, Sicily, Malta, Crete, the Ionian and the Balearic islands are the chief islands of Europe. The shores are very much indented, giving Europe an immense length of coast-line (estimated at nearly 50,000 miles). The chief seas or arms of the sea are: the White Sea on the north; the North Sea or German Ocean on the west, from which branches off the great gulf or inland sea known as the Baltic; the English Channel, between England and France; the Mediterranean communicating with the Atlantic by the Strait of Gibraltar (at one point only 19 miles wide); the Adriatic and Archipelago, branching off from the Mediterranean; and the Black Sea, connected with the Archipelago through the Hellespont, Sea of Marmora, and Bosphorus.

The mountains form several distinct groups or systems of very different geological dates, the loftiest mountain masses being in the south central region. The Scandinavian mountains in the northwest, to which the great northern peninsula owes its form, extend above 900 miles from the Polar Sea to the south point of Norway. The highest summits are about 8000 feet. The Alps, the highest mountains in Europe (unless Mount Elbruz in the Caucasus is claimed as European), extend from the Mediterranean first in a northerly and then in an easterly direction, and attain their greatest elevation in Mont Blanc (15,781 feet), Monte Rosa, and other summits. Branching off from the Alps, though not geologically connected with them, are the Apennines, which run southeast through Italy, constituting the central ridge of the peninsula. The highest summit is Monte Corno (9541 feet). Mount Vesuvius, the celebrated volcano in the south of the peninsula, is quite distinct from the Apennines. By southeastern extensions the Alps are connected with the Balkan and the Despoto-Dagh of the southeastern peninsula of Europe. Among the mountains of southwestern Europe are several massive chains, the loftiest summits being in the Pyrenees, and in the Sierra Nevada in the south of the Iberian Peninsula. The highest point in the former, La Maladetta or Mont Maudit, has an elevation of 11,065 feet; Mulahacen, in the latter, is 11,703 feet, and capped by perpetual snow. West and northwest of the Alps are the Cevennes, Jura, and Vosges; north and northeast, the Harz, the Thüringerwald, Mountains, the Fichtelgebirge, the Erzgebirge and Böhmerwaldgebirge. Further to the east the Carpathian chain incloses the great plain of Hungary, attaining an elevation of 8000 or 8500 feet. The Ural Mountains between Europe and Asia reach the height of 5540 feet. Besides Vesuvius other two volcanoes are Etna in Sicily, and Hecla in Iceland. A great part of northern and eastern Europe is level. The great plain of north Europe occupies part of France, western and northern Belgium, Holland, the northern provinces of Germany, and the greater part of Russia. A large portion of this plain, extending through Holland and North Germany, is a low sandy level not unfrequently protected from inroads of the sea only by means of strong dykes. The other great plains of Europe are the plain of Lombardy (the most fertile district in Europe) and the plain of Hungary. Part of southern and southeastern Russia consists of steppes.

The main European watershed runs in a winding direction from southwest to northeast, at its northeastern extremity being of very slight elevation. From the Alps descend some of the largest of the European rivers, the Rhine, the Rhone, and the Po, while the Danube, a still greater stream, rises in the Black Forest north of the Alps. The Volga, which enters the Caspian Sea, an inland sheet without outlet, is the longest of European rivers, having a direct length of nearly 1700 miles, including windings 2400 miles. Into the Mediterranean flow the Ebro, the Rhone, and the Po; into the Black Sea, the Danube, Dnieper, Dniester, and Don (through the Sea of Azov); into the Atlantic, the Gaudalquiver, the Guadiana, the Tagus, and the Loire; into the English Channel, the Seine; into the North Sea, the Rhine, the Elbe; into the Baltic, the Oder, the Vistula, and the Duna; into the Arctic Ocean, the Dwina. The lakes of Europe may be divided into two groups, the southern and the northern. The former run along both sides of the Alps, and among them, on the north side, are the lakes of Geneva, Neuchâtel, Thun, Lucerne, Zürich, and Constance; on the south side, Lago Maggiore, and the lakes of Como, Lugano, Iseo, and Garda. The northern lakes extend across Sweden from west to east, and on the east side of the Baltic a number of lakes, stretching in the same direction across Finland on the borders of Russia, mark the continuation of the line of depression. It is in Russia that the largest European lakes are found—Lakes Lagoda and Onega.

The geological features of Europe are exceedingly varied. The older formations prevail in the northern part as compared with the southern half and the middle region. North of the latitude of Edinburgh and Moscow there is very little of the surface of more recent origin than the strata of the Upper Jura belonging to the mesozoic period, and there are vast tracts occupied either by eruptive rocks or one or other of the older sedimentary formations. Denmark and the portions of Germany adjoining belong to the Cretaceous period, as does also a large part of Russia between the Volga and the basin of the Dnieper. Middle and eastern Germany with Poland and the valley of the Dnieper present on the surface Eocene for-

EUROPE

mations of the tertiary period. The remainder of Europe is remarkable for the great diversity of its superficial structure rocks and deposits belonging to all periods being found within it, and having for the most part no great superficial extent. Europe possesses abundant stores of those minerals which are of most importance to man, such as coal and iron, Britain being particularly favored in this respect. Coal and iron are also obtained in France, Belgium, and Germany. Gold is found to an unimportant extent, and silver is widely spread in small quantities. The richest silver ores are in Norway, Spain, the Erzgebirge, and the Harz Mountains. Spain is also rich in quicksilver. Copper ores are abundant in the Ural Mountains, Thuringia, Cornwall, and Spain. Tin ores are found in Cornwall, the Erzgebirge, and Brittany.

Several circumstances concur to give Europe a climate peculiarly genial, such as its position almost wholly within the temperate zone, and the great extent of its maritime boundaries. Much benefit is also derived from the fact that its shores are exposed to the warm marine currents and warm winds from the southwest, which prevent the formation of ice on most of its northern shores. The eastern portion has a less favorable climate than the western. The extremes of temperature are greater, the summer being hotter and the winter colder, while the line of equal mean temperature decline south as we go east. The same advantages of mild and genial temperature which western has over eastern Europe, the continent collectively has over the rest of the Old World. The diminution of mean temperature, as well as the intensity of the opposite seasons, increases as we go east. Peking, in lat. 40° n., has as severe a winter as St. Petersburg in lat. 60°.

With respect to the vegetable kingdom Europe may be divided into four zones. The first, or most northern, is that of fir and birch. The birch reaches almost to North Cape; the fir ceases a degree further south. The cultivation of grain extends further north than might be supposed. Barley ripens even under the seventieth parallel of north latitude; wheat ceases at 64° in Norway, 62° in Sweden. Within this zone, the southern limit of which extends from lat. 64° n. Norway to lat. 62° in Russia, agriculture has little importance, its inhabitants being chiefly occupied with the care of reindeer or cattle, and in fishing. The next zone, which may be called that of the oak and beech, and cereal produce, extends from the limit above mentioned to the 48th parallel. The Alps, though beyond the limit, by reason of their elevation belong to this zone, in the moister parts of which cattle husbandry has been brought to perfection. Next we find the zone of the chestnut and vine, occupying the space between the 48th parallel and the mountain chains of southern Europe. Here the oak still flourishes, but the pine species become rarer. Rye, which characterizes the preceding zone on the continent, gives way to wheat, and in the southern portions of it to maize also. The fourth zone, comprehending the southern peninsulas, is that of the olive and evergreen woods. The orange flourishes in the southern portion of it, and rice is cultivated in a few spots in Italy and Spain.

As regards animals the reindeer and polar-bears are peculiar to the north. In the forest of Poland and Lithuania the urus, a species of wild ox, is still occasionally met with. Bears and wolves still inhabit the forests and mountains; but, in general, cultivation and population have expelled wild animals. The domesticated animals are nearly the same throughout. The ass and mule lose their size and beauty north of the Pyrenees and Alps. The Mediterranean Sea has many species of fish, but no great fishery; the northern seas, on the other hand, are annually filled with countless shoals of a few species, chiefly the herring, mackerel, cod, and salmon.

Europe is occupied by several different peoples or races, in many parts now greatly intermingled. The Celts once possessed the west of Europe from the Alps to the British Islands. But the Celtic nationalities were broken by the wave of Roman conquest, and the succeeding invasions of the Germanic tribes completed their political ruin. At the present day the Celtic language is spoken only in the Scotch Highlands (Gaelic), in some parts of Ireland (Irish), in Wales (Cymric), and in Brittany (Armorican). Next to the Celtic comes the Teutonic race, comprehending the Germanic and Scandinavian branches. The former includes the Germans, the Dutch, and the English. The Scandinavians are divided into Danes, Swedes, and Norwegians. To the east, in general, of the Teutonic race, though sometimes mixed with it, come the Slavonians, that is, the Russians, the Poles, the Czechs or Bohemians, the Servians, Croatians, etc. In the south and southeast of Europe are the Greek and Latin peoples, the latter comprising the Italians, French, Spanish, and Portuguese. All the above peoples are regarded as belonging to the Indo-European or Aryan stock. To the Mongolian stock belong the Turks, Finns, Lapps, and Magyars or Hungarians, all immigrants into Europe in comparatively recent times. The Basques at the western extremity of the Pyrenees are a people whose affinities have not yet been determined. The total population of Europe is about 330,000,000; nine-tenths speak the languages of the Indo-European family, the Teutonic group numbering about 108,000,000, the Slavonic and Latin over 95,000,000 each. The prevailing religion is the Christian, embracing the Roman Catholic, various sects of Protestants (Lutheran, Calvinistic, Anglican, Baptists, Methodists, etc.), and the Greek Church. A part of the inhabitants profess the Jewish, a part the Mohammedan religion

The states of Europe, with their respective areas and populations, are as shown below. In addition to those given in the table, there are also the insignificant states of Andorra, Monaco, and San Marino, which still maintain a kind of precarious independence.

States.	Area in Eng. sq. Miles.	Population.	Designation.
Austria-Hungary	240,942	46,973,359	Empire.
Liechtenstein	62	9,124	Principality.
Bosnia, Herzegovina, etc	23,262	1,504,091	Annexed by Austria.
Belgium	11,373	7,074,910	Kingdom.
Denmark	14,789	2,484,770	Kingdom.
Faroe and Iceland	40,266	83,665	
France	204,090	39.118,995	Republic.
Germany	211,149	60,600,183	Empire.
Britain	120,832	41,606.177	Kingdom.
European Possessions	145	175,186	
Greece	25,014	2,433,806	Kingdom.
Netherlands	12,648	5,347,182	Kingdom.
Luxemburg	999	213,283	Grand-duchy.
Italy	114,410	32,475,253	Kingdom.
Montenegro	3,658	236,000	Principality.
Portugal	36,028	5,423,132	Kingdom.
Roumania	48.307	5,500,000	Kingdom
Russia	2,095,504	143,364,649	Empire.
Servia	18,800	2,493,691	Kingdom.
Spain	191,100	18,891,574	Kingdom.
Sweden	170,979	5,136,441	Kingdom.
Norway	122,869	2,240,032	Kingdom.
Switzerland	15,992	3,315,443	Confederative Republic.
Turkey	63,850	6,130,200	Empire.
Bulgaria	24,650	3,744,300	Principality.
Eastern Roumelia	13.500	.....	Joined to Bulgaria.

Europe was probably first peopled from Asia, but at what date we know not. The first authentic history begins in Greece at about 776 B.C. Greek civilization was at its most flourishing period about 430 B.C. After Greece came Rome which, by the early part of the Christian era, had conquered Spain, Greece, Gaul, Helvetia, Germany, between the Danube and the Alps, Illyria, Dacia, etc. Improved laws and superior arts of life spread with the Roman empire throughout Europe, and the unity of government was also extremely favorable to the extension of Christianity. With the decline of the Roman Empire a great change in the political constitution of Europe was produced by the universal migration of the northern nations. The Ostrogoths and Lombards settled in Italy, the Franks in France, the Visigoths in Spain, and the Anglo-Saxons in South Britain, reducing the inhabitants to subjection, or becoming incorporated with them. Under Charlemagne (771–814) a great Germanic empire was established, so extensively that the kingdom of France, Germany, Italy, Burgundy, Lorraine, and Navarre were afterward formed out of it. About this time the

northern and eastern nations of Europe began to exert an influence in the affairs of Europe. The Slavs, or Slavonians, founded kingdoms in Bohemia, Poland, Russia, and the north of Germany; the Magyars appeared in Hungary, and the Normans agitated all Europe, founding kingdoms and principalities in England, France, Sicily, and the East. The Crusades and the growth of the Ottoman power are among the principal events which influenced Europe from the 12th to 15th century. The conquest of Constantinople by the Turks (1453), by driving the learned Greeks from this city, gave a new impulse to letters in western Europe, which was carried onward by the invention of printing, and the Reformation. The discovery of America was followed by the temporary preponderance of Spain in Europe, and next of France. Subsequently Prussia and Russia gradually increased in territory and strength. The French revolution (1789) and the Napoleonic wars had a profound effect on Europe, the dissolution of the old German Empire being one of the results. Since then the most important events in European history have been the establishment of the independence of Greece; the disappearance of Poland as a separate state; the unification of Italy under Victor Emmanuel; the Franco-German war, resulting in the consolidation of Germany into an empire under the leadership of Prussia; and the partial dismemberment of the Turkish Empire.

EURYDICE (ū-rid'i-sē), in Greek mythology, the wife of Orpheus. See Orpheus.

EUSE'BIUS, the father of ecclesiastical history, a Greek writer, born in Palestine about 265 A.D., died about 340. About 315 he was appointed Bishop of Cæsarea. He became an advocate of the Arians and condemned the doctrines of Anthanasius. His ecclesiastical history extends from the birth of Christ to 324. Among his other extant works is a life of Constantine the Great.

EUS'TIS, James Biddle, an American lawyer, was born in New Orleans in 1834. During the civil war he served in the Confederate army as judge-advocate on the staffs of Generals Magruder and Johnston, and afterward was one of the commissioners sent by Louisiana to confer with President Johnson with regard to the "reconstruction" of that state. He served for several terms in the state legislature, and was afterward twice sent to the U. States senate, serving from 1877 to 1879, and again from 1885 to 1891. From 1879 to 1884 he was professor of civil law in the University of Louisiana, and from 1893 to 1899, after his second term in the senate, was U. States minister and first U. States ambassador to France. He died in 1899.

EUTHANASIA, (ū'thȧ-nā'zhĭ-ȧ), the use of narcotics or other means for shortning life, in disease, has become a subject of discussion in civilized countries; and it is often a very practical question as to how far such means are admissible for soothing the last hours of life, when the approach of death does not of itself dull the consciousness and the sensibility to pain. It must be decided according to all the surrounding circumstances, medical and otherwise, in each individual case.

EUXANTHINE, a substance supposed to be derived from the bile or urine of the buffalo, camel, or elephant. It comes from India under the name of purree or Indian yellow, and is used as a pigment.

EUX'INE, the ancient name for the Black Sea.

EVANGEL'ICAL, a term often used to qualify certain theological views, especially strict views on the question of the atonement, justification by faith, the inspiration and authority of the Scriptures and allied doctrines. In a more general sense the word implies a peculiar fervency and earnestness in insisting on such doctrines as regeneration, redemption, etc.

EVANGELICAL ALLIANCE, an association of members of different sections of the Christian church, organized in London in 1846, to lend its influence in favor of evangelical doctrines, religious union and liberty, and against superstition and unbelief. The alliance has branches throughout the world, the American branch being especially strong and has held meetings at Paris, Berlin, Amsterdam, Geneva, New York, etc.

EVAN'GELISTS, the writers of the history or doctrines, precepts, actions, life, and death of Christ; in particular, the four evangelists, Matthew, Mark, Luke, and John. The ancient symbols of the four evangelists are: for Matthew, a man's face; for Mark, a lion; for Luke, an ox; and for John, a flying eagle.

EVANS, Marian. See Eliot, George.

EV'ANS, Oliver, born at Newport, Del., in 1755, was the inventor of the automatic flour-mill and the high-pressure steam-engine. He died in New York, 21st April, 1819.

EVANS, Robley Dunglison, naval officer, born in Virginia in 1846. In the civil war he took part in both attacks on Fort Fisher, and was so seriously wounded that he was retired from active service. After his recovery he was restored to the service at his own request. During the Chilian imbroglio of 1891 he commanded the Yorktown; in 1896 he was put in command of the Indiana, and in 1898 was put in command of the Iowa, which was assigned to blockade duty off the coast of Cuba during the war with Spain, and which took a prominent part in the battle of July 3 near Santiago. In Oct., 1898, he was appointed a member of the board of inspection and survey. He published A Sailor's Log in 1901.

EV'ANSTON, a town in Illinois, on Lake Michigan, 12 miles n. of Chicago. It has a university with museum and extensive library. Pop. 25,620.

EV'ANSVILLE, a city in Indiana, pleasantly situated on a height above the Ohio. It contains some handsome buildings, including custom-house and post-office, etc. Coal and iron abound in the vicinity, and there are numerous factories, flour-mills, iron-foundries, etc., and a large shipping trade. Pop. 69,140.

EVAPORATION, the conversion of a liquid or solid by heat into vapor or steam, which becomes dissipated in the atmosphere in the manner of an elastic fluid. The process of evaporation is constantly going on at the surface of the earth, but principally at the surface of the sea, of lakes, rivers, and pools. The vapor thus formed, being specifically lighter than atmospheric air, rises to considerable heights above the earth's surface; and afterward, by a partial condensation, forms clouds, and finally descends in rain.

EVARTS, Wm. M., was born in Boston, in 1818. In 1868 was counsel for President Johnson in the impeachment trial. In 1872 was counsel for the U. States in the Alabama claims. His fees have amounted to $50,000 for a single opinion. He was secretary of state under President Hayes, and U. States senator from 1885 to 1891. He died 1901.

EVENING-STAR, or Hesperus, the name given to the planet Venus when visible in the evening. See Venus.

EVERETT, Edward, an American statesman and author, born at Dorchester, Massachusetts, April 11, 1794. After traveling for some years in Germany and England he returned to America in

Edward Everett.

1819 to occupy the chair of Greek literature at Harvard. He became editor of the North American Review, and entering the political world became successively member of Congress, governor of Massachusetts, and minister plenipotentiary in England (1840). In 1845 he was appointed president of Harvard College, and in 1852 secretary of state. Shortly after he retired into private life. He died at Boston, January 15, 1865.

EVERETT, a city in Middlesex co., Mass., adjoining Boston, Chelsea, and Malden, of which last it formed part until incorporated as a town in 1870. Pop. 29,625.

EVERGLADES, a low marshy tract of country in Southern Florida, inundated with water and interspersed with patches or portions covered with high grass and trees. They are 160 miles long and 60 broad.

EVERGREEN, a plant that retains its verdure through all the seasons, as the fir, the holly, the laurel, the cedar, the cypress, the juniper, the holm-oak, and many others. Evergreens shed their old leaves in the spring or summer, after the new foliage has been formed, and consequently are verdant through all the winter season. They form a considerable part of the shrubs commonly cultivated in gardens, and are beautiful at all seasons of the year.

EVERLASTING-FLOWERS, a name applied to certain plants which, when

dried, suffer little change in their appearance.

EV'EREST, MOUNT, the highest mountain of the earth; in the eastern range of the Himalayas, in Northern Nepaul; lat. 27° 59′ 12″ n., lon. 86° 58′ 6″ e. According to the measurement of Waugh in 1856, the altitude is 29,002 feet.

EVERSION OF THE EYELIDS, ectropium, a disease in which the eyelids are turned outward, so as to expose the red internal tunic. It occurs most frequently in the lower eyelid.

EVICTION, the dispossession of a person from the occupancy of lands or tenements. The term occurs most commonly in connection with the proceedings by which a landlord ejects his tenant for non-payment of rent or on determination of the tenancy. In the case of evictions of tenants in Ireland, generally for non-payment of rent, the tenants are frequently readmitted as caretakers, or under some other title.

EVIDENCE is that which makes evident, which enables the mind to see truth. It may be (a) intuitive, i. e. resting on the direct testimony of consciousness, of perception or memory, or on fundamental principles of the human intellect; or it may be (b) demonstrative i.e. in a strict sense, proofs which establish with certainty as in mathematical science certain conclusions; or it may be (c) probable, under which class are ranked moral evidence, legal evidence, and generally every kind of evidence which, though it may be sufficient to satisfy the mind, is not an absolutely certain and incontrovertible demonstration.

EVIDENCES OF CHRISTIANITY, these may be divided broadly into two great classes, viz. external evidences, or the body of historical testimonies to the Christian relation; and internal evidences, or arguments drawn from the nature of Christianity itself as exhibited in its teachings and effects, in favor of its divine origin. The first Christian apologies—those of Justin Martyr, Minucius Felix, and Tertullian, written in the 2d century—were mainly intended as justifications of the Christian religion against the charges of atheism, immorality, etc., commonly made at that time. Of a more philosophical kind and dealing more comprehensively with the principles of religion and belief in general, are the works of Origen, Arnobius, and Augustine in the centuries immediately succeeding. During the middle ages, the scientific representation of Christianity is mostly the work of the schoolmen occupied in welding Aristotelian or Platonic philosophy with the fabric of Christian dogmatics, or writing attacks on the Jewish and Mahommedan faiths.

EVIL EYE, a power which, according to an old and wide-spread superstition, resides in some people of doing injury to others by a mere look, or a look accompanied by certain words or charms. This belief, common among the ancients, is still prevalent among the more ignorant classes in Italy, Russia, Andalusia, Turkey, Egypt, the Highlands of Scotland, and other places.

EVOLUTION, a term used to denote (usually) the theory that all forms of life are derived from one or a few forms which, by gradual change, have been transmitted into the millions of forms we now see. The general idea of evolution was familiar to the ancients, but it was not until Goethe, Lamarck, and Kant suggested the cousinship of all living things that the idea of modern evolution arose.

The chief interest attaching to evolution in the popular mind dates from Darwin's work, "The Origin of Species," because it was seen that if Darwin's theory was true, man was not specially created by a deity but was descended in a straight line from an ape-like animal, and more remotely from still lower forms.

Darwin's theory is important not because it holds that man is thus descended, but because it was the first rational attempt to establish the doctrine of evolution on a scientific basis. The heart of Darwinism is the process he calls "natural selection." Organisms inherit their traits from their parents. But as a new generation is slightly different from the preceding generation, the individuals having favorable traits survive, while those who have not, perish. Thus the "unfit" are eliminated before they can propagate; and this process, going on for centuries or ages, produces the most divergent types. In this way millions of species have disappeared and the millions that survive are still changing their forms. It has been well said that before Darwin the living beings of the earth were as wax-figures in a museum. Darwin's suggestion imbued them with life and they began to move.

Since Darwin's time natural selection has been applied to the entire universe; to the survival of chemical elements, which, among themselves, are in a "struggle for existence"; to the evolution of star-clusters and planet-systems; to disease, to society, in a word to all the phenomena of being.

The doctrine of evolution as applied to man is of special interest. Man is the most highly organized member of the animal world. The endeavor has often been made in classification to separate man from the brute creation. One system, expressing a vast gap between the Quadrumana and man, classifies man in the order Bimana ("two-handed"), the highest division of the Mammalian class; and relegates the monkeys and apes to the lower and distinct order—that of the Quadrumana ("four-handed"). The more recent arrangements, however, classify man and the monkeys in one order, making man the highest family or group of this order. From the purely anatomical point of view the differences which separate the anthropoid apes from man are in some respects less than those which separate these higher apes from apes lower in the scale. But the mental or psychical endowments of man oblige us to remove him far above the highest Quadrumana; and even the characters by which he is anatomically separated from the highest apes form a very distinct and appreciable series. The first grand characteristic of man is his erect position and bipedal progression. The lower limbs, with the feet broad and plantigrade and the well-developed heel, are devoted exclusively to progression and supporting the weight of the body; while the upper limbs have nothing to do with progression, but subserve prehension entirely. The bones of the face in man do not project forward, while they are elongated in a downward direction; and the face and forehead are in the more civilized races situated nearly in the same plane, so that the face immediately underlies the brain. Similarly the development of a distinct chin is also a peculiarly human feature, and one which in the highest varieties of mankind becomes most marked. The great cranial capacity of man, or the greater size of the cranial or brain portion as compared with the facial portion of the skull, forms another noteworthy and distinctive character of the human form. The brain convolutions also are more numerous and complex than is the case with any other mammal. The teeth of man are arranged in a continuous series, and without any diastema or interval. The development of hair too is very partial. The gorilla presents of all the apes the nearest approach to the human type taken in its entirety; but it differs in the relative number of vertebræ (13 dorsa

Skeletons of the

GIBBON. ORANG. CHIMPANZEE. GORILLA. MAN.

Photographically reduced from Diagrams of the natural size (except that of the Gibbon, which was twice as large as nature), drawn by Mr Waterhouse Hawkins from specimens in the Museum of the Royal College of Surgeons.

and 4 lumbar, to 12 and 5 respectively in man), in the order of dental succession and in the presence of the interval or diastema, in the less prominent muscular development of the buttocks and calves, and in other minor differences. The orangs most closely approach man's structure in the number of ribs and in the form of the cerebrum, while they exhibit the greatest differences from him in the relative length of the limbs. The chimpanzees are most anthropoid in the shape of the cranium, in the arrangement and succession of the teeth, and in the length of the arms as compared with that of the legs. Of the higher apes the gibbons are those furthest removed from the human type of structure. Chief among the psychical features, or rather among the results of the operation of the principle of mind, we note the possession of the moral sense of right and wrong. The possession of an articulate language, by which he can communicate his thoughts, is also the exclusive possession of man, and draws a sharp line of separation between him and all other animals. With regard to the geological history of man, the earliest traces yet discovered belong to the Post-pliocene deposits in conjunction with existing species of shells and some extinct species of mammals. Man's advent upon the earth is consequently referred to a period much anterior to that which former limits and theological ideas prescribed. Among the modern theories regarding the origin of man may be noted those of (1) Darwin; that man is directly descended from an extinct form of anthropoid ape, with a tail and pointed ears, arboreal in its habits and an inhabitant of the Old World; further, that man has diverged into different races or subspecies, but that all the races agree in so many unimportant details of structure, and in so many mental peculiarities, that they can be accounted for only through inheritance from a common progenitor. (2) Wallace also affirms the original unity of man, and places him apart as not only the head and culminating point of the grand series of organic nature, but as, in some degree, a new and distinct order of being; maintaining that a superior intelligence has guided the development of man in a definite direction and for a special purpose, just as man guides the development of many animal and vegetable forms. (3) Carl Vogt holds a plurality of the race; adopts Darwin's idea of natural selection accounting for the origin and endowments of man, but rejects Wallace's idea of the higher controlling intelligence. (4) Mivart propounds a theory of a natural evolution of man as to his body, combined with a supernatural creation as to his soul.

EWALD (ā'vält), Johannes, Danish poet, born at Copenhagen in 1743. After studying theology at Copenhagen University he ran away and enlisted in the Prussian service, which he soon deserted for the Austrian. Having returned to Copenhagen an elegy which he wrote on the death of Frederick V., of Denmark was received with general admiration, and awoke in himself the consciousness of poetic talent. His reputation rapidly increased with the publication of his tragedies, The Death of Balder, Adam and Eve, Rolfkrage, etc.; and his odes and songs.

EWELL, Benjamin Stoddert, American educator, born in Washington, D. C., in 1810. He was professor of mathematics at Hampden-Sidney College in 1839–1846 and filled a similar chair at Washington University in 1854, and William and Mary College of which he became president in 1854. He was in command of the 32nd regiment Virginia Volunteers from 1861–2 and adjutant-general of the confederate army on the staff of Gen. Joseph E. Johnston when he was commander of the department of Tennessee and Mississippi. He died in 1883.

EWELL, Richard Stoddert, American soldier, born in Georgetown, D. C., in 1817. He served during the Mexican war with Scott from Vera Cruz to the City of Mexico. He was actively engaged on the side of the confederacy during the civil war and attained the rank of lieutenant-general. He was placed in command of the second corps of Gen. Lee's army upon the death of "Stonewall" Jackson. He led the charge of the corps at the capture of Winchester, at Gettysburg, the Wilderness and, Spottsylvania Court House. He died in 1872.

EWING, Thos., statesman, was born in Ohio co., Va., in 1789. In 1831 and 1850 was elected to the U. States senate. In 1841 appointed Secretary of the Treasury. In 1849 was made the first secretary of the interior. He died in 1871.

EX'CELLENCY, a title given to ambassadors and plenipotentiaries, governors of colonies, the president of the United States, etc.

EXCELSIOR, a material widely used for packing and as stuffing in mattresses and upholstery. It is made from logs of wood that have been divided into 18 inch blocks. The fibers are separated from the blocks by knife-points and packed in bales of 250 pounds weight. About 45,000 tons are manufactured annually in the U. States of which large quantities are exported.

EXCHANGE, a place in large commercial towns where merchants, agents, bankers, brokers, and others concerned in commercial affairs meet at certain times for the transaction of business. The institution of exchanges dates from the 16th century. They originated in the important trading cities of Italy, Germany, and the Netherlands, from which last-named country they were introduced into England. In some exchanges only a special class of business is transacted. Thus there are stock exchanges, corn exchanges, coal exchanges, cotton exchanges, etc.

EXCHANGE, in commerce, that species of transactions by which the debts of individuals residing at a distance are canceled by order, draft, or bill of exchange, without the transmission of specie. The process of liquidating obligations between different nations is carried on in the same way by an exchange of foreign bills. When all the accounts of one country correspond in value with those of another, so that there is an even balance, the exchange between the countries will be at par, that is, the sum for which the bill is drawn in the one country will be the exact value of it in the other. Exchange is said to be at par when, for instance, a bill drawn in New York for the payment of $500 in London can be purchased there for $500. If it can be purchased for less, exchange is under par and is against London. If the purchaser is obliged to give more, exchange is above par and in favor of London. Although the thousand circumstances which incessantly affect the state of debt and credit prevent the ordinary course of exchange from being almost ever precisely at par, its fluctuations are confined within narrow limits, and if direct exchange is unfavorable between two countries this can often be obviated by the interposition of bills drawn on other countries where an opposite state of matters prevails. See also Bill of Exchange.

EXCHEQ'UER, in Britain, the department which deals with the moneys received and paid on behalf of the public services of the country. The public revenues are paid into the Bank of England (or of Ireland) to account of the exchequer, and these receipts as well as the necessary payments for the public service are under the supervision of an important official called the controller and auditor general, the payments being granted by him on receipt of the proper orders proceeding through the treasury. The public accounts are also audited in his department.

EXCISE', an inland duty or impost laid on commodities produced and consumed within a country, and also on licenses to manufacture and deal in certain commodities.

EXCOMMUNICATION, the exclusion of a Christian from the communion and spiritual privileges of the church. Excommunication was practiced early by the Christian church. A distinction gradually arose between a lesser and a greater excommunication, the former being a suspension from church privileges, the latter a formal expulsion excluding from all communion with the faithful. In the middle ages the pope often excommunicated whole cities and kingdoms. In such a case all religious services ceased and the grave inconveniences thus caused made excommunication a formidable weapon in the hands of the pope, till with frequent abuse it lost its force. Besides excommunication an extreme degree of denunciation called anathema, and cutting the offender off from all the hopes and consolations of the Christian faith, is used in the Roman Catholic Church. In the Church of England both the less and the greater excommunication are recognized.

EXCRE'TION, in physiology, the separation and carrying off of waste matter from an animal body, a function performed by the lungs, kidneys, bladder, and the skin, besides the action of the intestinal canal.

EXECUTION, in law, is a judicial writ grounded on a judgment of the court by which the writ is issued, and is granted for the purpose of carrying the judgment into effect, by having it executed. Exe-

cution is granted by a court only upon the judgments given by the same court, not upon those pronounced by another.

EXECUTIONER, the official who carries into effect a sentence of death, or inflicts capital punishment in pursuance of a legal warrant. In England the duty of executing the extreme sentence of the law devolves upon the sheriff, and in Scotland on the civic magistracy, but in practice the duty is performed by another in their presence. In the U. States the duty devolves upon the sheriff.

EXEC'UTIVE, that branch of the government of a country by which the laws are carried into effect or the enforcement of them superintended. The term is used in distinction from the legislative and the judicial departments, and includes, the supreme magistrate whether emperor, king, president, or governor, his cabinet or ministers, and a host of minor officials.

EXEC'UTOR, in law, is one appointed by a man's last will to carry its provisions into execution after the testator's death. The testator may, by the common law, appoint any person of sound mind and discretion, though otherwise under some legal disabilities as to contracting and transacting business in general, such as a married woman, or a minor. The duties of executors and of administrators are, in general, the same, the difference of the two depending mostly on the mode of appointment, the executor being nominated by the testator, the administrator being appointed by the judge of probate. An executor is liable for any loss occurring to the estate through negligence; for paying legatees before all debts are discharged.

EXEGESIS (-jē'sis), the exposition or interpretation of the Scriptures. The science which lays down the principles of the art of sacred interpretation is called exegetics or hermeneutics.

EX'ETER, a city, river-port, and parliamentary and municipal borough of England, in the county of Devon, on the left bank of the Exe, 10 miles northwest from its outlet in the English Channel. By means of a canal vessels of 300 tons can reach the city. The largest vessels remain at Exmouth. Exeter is a place of remote antiquity, having been a British settlement long prior to the invasion of the Romans, Pop. 37,580.

EXHIBITION, Industrial, an exhibition of works of industry and art for the purpose of exciting public interest and promoting trade and manufactures. In 1798 an industrial exhibition of the products of French industry was held at Paris, and proved so successful that in 1802, during the consulate of Napoleon, another was held. The beneficial effects of these exhibitions were so obvious that a series of them was held at intervals, the eleventh and last being held at Paris in 1849. In Britain exhibitions of a more or less local nature had been held in Dublin (1829), Manchester, Liverpool, and Birmingham, and annually in London in the premises of the Society of Arts. All these had been generally successful, but the necessity of holding one on an international scale was first brought fairly before the public in 1848 by Prince Albert. A vast structure of iron and glass, the design of Joseph Paxton, was erected in Hyde Park, London, and was opened by Queen Victoria on the 1st of May, 1851. The entire area was about 19 acres; the number of exhibitors reached 15,000. In 1855 the first French Exposition Universelle was opened in Paris. The buildings were erected in the Champs Elysées, and covered about 24 acres. There were in all about 24,000 exhibitors. This was followed by the national exhibitions of the Dutch at Haarlem and the Belgians at Brussels, both in 1861, and the following year by the second great international exhibition held in London. The second French International Exhibition was opened on the 1st April, 1867, and closed on the 3d November. It was erected on the Champ de Mars, and covered about 37 acres. The exhibitors numbered nearly 50,000, the visitors about 10,000,000. In 1873 the first Austrian international exhibition was held in Vienna. A great exhibition was held at Philadelphia in 1876 upon the occassion of the centennial festival of the American declaration of independence. It occupied 60 acres, and had nearly 10,000,000 visitors. A third French International Exhibition was held at Paris in 1878, the area occupied amounting in all to 140 acres, the visitors numbering about 17,000,000. A fourth was held in 1889, the latter being partly intended to commemorate the centenary of the French Revolution. One of the features in connection with it is the famous Eiffel Tower of iron, 984 feet high, and thus more than 400 feet higher than any other structure. In 1883 a series of exhibitions began at South Kensington, London, where the exhibits were confined to articles having relation to a special department. To this series belonged The Fisheries Exhibition of 1883, the Health Exhibition of 1884, the Exhibitions of Inventions in 1885 and the Exhibition of Colonial and Indian Products in 1886. This latter was visited by 5,550,749 persons. Besides these Edinburgh had an International Exhibition of Industry, Science, and Arts in 1886, visited by 2,769,632 persons. In 1887 a Royal Jubilee Exhibition of Arts and Manufactures was opened at Manchester, and was visited by 4,765,000 persons In the following year a great International Exhibition of Industry, Science, and Art was held at Glasgow, and attracted during the season 5,748,379 visitors. In 1892-93 an International Exhibition of majestic proportions was held in Chicago, Illinois, to commemorate the 400th anniversary of the discovery of America. The total number of visitors was 27,539,521. This exhibition presented the finest examples of architectural beauty and grandeur ever seen on earth. Other notable exhibitions in the U. S. were the California Mid-Winter Exhibition in San Francisco in 1894; The Cotton States and Industrial Exposition in Atlanta, Ga., in 1895; the Tennessee Centennial Exposition in Nashville in 1897. In 1898 the Trans-Mississippi Exposition at Omaha, Neb., was unqualifiedly successful. In 1899 a National Export Exposition was held in Philadelphia, which resulted in a great increase of foreign trade. The Pan-American Exposition in Buffalo to celebrate the achievements of the Western Hemisphere during one hundred years, and to promote commerce among the Pan-American countries, was opened May 1 and closed Nov. 1, 1901. The site occupied 350 acres. The South Carolina Inter-State and West Indian Exposition in Charleston in 1901-02, the World's Fair in St. Louis in 1904 in celebration of the Louisiana purchase. The French held a great International Exposition at Paris, 1900, which, in the number of admissions, was far in excess of any similar affair. This was opened by President Loubet, April 14, and closed Nov. 12.

EXILE, the condition of a person who either voluntarily or by penal sentence absents himself from his own country in order to escape the consequences to life, liberty, or property that residence at home would bring with it; also, the person who so absents himself. Exile is as a punishment unknown to English law, unless it be in the form of transportation by act of Parliament, or as a condition of release by the executive from a capital or other severe punishment.

Free countries, unless overawed by superior power, have generally given refuge to political exiles, and seldom have they delivered them up on demand from the exile's country. This was the boast of Athens, which Demosthenes calls the common place of refuge for Greece; he also pronounces it to be the common usage of all men to give shelter to an exile. The connection of the exile with his native land of course ceases. The jurisdiction over him depends on the laws of the land where he is domiciled. If, as sometimes happens, he engages in plots with accomplices in his native country, he is amenable to the law of his domicile for any criminal acts he may commit within its jurisdiction. Such a person is sometimes demanded by the authorities of his original home, in order to be proceeded against by its laws and modes of trial. But a free country will refuse to surrender its territorial rights in such cases.

EXMOUTH, Edward Pellew, Viscount, a British naval officer, born in 1757. He went to sea at the age of thir-

Viscount Exmouth.

teen, served as midshipman in the Blon frigate during the American war, an greatly distinguished himself at Lal Champlain. In 1804 we was sent to tal the chief command on the East Indi

station, in the Culloden, of seventy-four guns; and here he remained till 1809, when he had attained the rank of vice-admiral. In 1816 he proceeded to Algiers in command of a combined fleet of twenty-five English and Dutch ships to enforce the terms of a treaty regarding the abolition of Christian slavery which the dey had isolated. He bombarded the city for seven hours, and inflicted such immense damage that the dey consented to every demand. Twelve hundred Christian slaves were by this exploit restored to liberty. Lord Exmouth was raised to the dignity of a viscount for this service. He died in 1833.

EX'ODUS, the name given in the Septuagint to the second book of the Pentateuch, because it describes the departure of the Israelites from Egypt. The contents of the book are partly historical describing the departure of the Israelites from Egypt, and partly legislative, describing the promulgation of the Sinaiti law. One of the difficulties connected with this book is that, according to Scriptural chronology, the residence of the Israelites in Egypt was only 215 years, and it seems incredible that in this time "the threescore and ten souls" who accompanied Jacob to Egypt could have become the two and a half millions who left with Moses.

EXOGENOUS PLANTS (eks-oj'e-nus), or **EXOGENS,** those plants whose stems are formed by successive additions to the outside. The exogens are the largest primary class of plants in the vegetable kingdom, and their increase by annual additions of new layers to the outside of

Exogenous plants.

1, Section of a branch of three years' growth. *a*, Medulla or pith. *b*, Medullary sheath. *e e*, Medullary rays. *c c*, Circles of annual growth. *d*, Bark. 2, Netted veined leaf of exogen (Oak). 3, Dicotyledonous seed of exogen. *a a*, Cotyledons. 4, Germination of dicotyledonous seed. *a a*, Seed-leaves of cotyledons. *o*, Plumula. 5, Exogenous flower (crowfoot).

their stems, formed in the cambium between the wood and the bark, is a feature in which they differ essentially from endogens, whose wood is formed by successive augmentations from the inside. The concentric circles thus annually formed, distinguishable even in the oldest trees, aid in computing the age of the tree. The stem and branches also exhibit a central pith and medullary rays extending outwards to the bark. All the trees of cold climates, and the principal part of those in hot, are exogenous, and are readily distinguished from those that are endogenous by the reticulated venation of their leaves, and by their seeds having two cotyledons (dicotyledonous). The parts of the flower are generally in fours or fives.

EX'ORCISM, the casting out of evil spirits by certain forms of words or ceremonies. An opinion prevailed in the ancient church that certain persons, those particularly who were afflicted with certain diseases, especially madness and epilepsy, were possessed by evil spirits. Over such persons forms of conjuration were pronounced, and this act was called exorcism. There were even certain men who made this a regular profession, and were called exorcists. Exorcism still makes a part of the beliefs of some churches. In the Roman Catholic Church exorcist is one of the inferior orders of the clergy.

EXOT'IC, belonging to foreign countries; a term used especially of plants. Exotic plants are such as belong to a soil and climate entirely different from the place where they are raised. They are nearly always greenhouse or hothouse plants.

EXPANSION, in physics, is the enlargement or increase in the bulk of bodies, in consequence of a change in their temperature. This is one of the most general effects of heat, being common to all bodies whatever, whether solid or fluid. The expansion of fluids varies considerably, but, in general, the denser the fluid, the less the expansion; thus water expands more than mercury, and spirits of wine more than water; and, commonly, the greater the heat, the greater the expansion; but this is not universal, for there are cases in which expansion is produced, not by an increase, but by a diminution of temperature. Water, in cooling, ceases to contract at 42° F.; and at about 39°, just before it reaches the freezing point (32°), it begins to expand again, and more and more rapidly as the freezing point is reached. This expansion is about one-eleventh of its bulk, and accounts for the bursting of pipes, etc., when water is freezing in them.

EX PARTE, a title frequently used in legal proceedings. If Black is adjudged bankrupt the title of the bankruptcy proceedings is In re Black; and if a creditor named Smith makes an application in the cause for an order or determination in his behalf, his proceeding is entitled, Ex parte Smith in re Black. So if Jones applied for leave to sue on official bond this preliminary proceeding is entitled Ex parte Jones. The term is also used to describe the application or proceeding itself: Statements made in a judicial proceeding under such circumstances that the opposite party has no opportunity to challenge their accuracy are often spoken of as ex parte.

EXPATRIATION, the voluntary abandonment of one's native country with the intention of becoming a citizen of another state. The right of a person to throw off the obligation of allegiance has been denied by eminent writers and some governments. The true view would seem to be that the power to determine when the allegiance of the citizen may cease belongs to the state of which he is a member, rather than to himself. At the same time the freedom of intercourse between nations in modern times and the interests of civilization require that the various nations should provide liberal rules by which at proper times the relation of the citizen to the state may cease, and the individual, freed from the ties of burdensome allegiance, may assume another citizenship if he so desire.

EXPECTATION, in the doctrine of chances, the value of any prospect of prize or property depending upon the happening of some uncertain event. A sum of money in expectation upon a certain event has a determinate value before that event happens. If the chances of receiving or not receiving a hundred pounds, when an event arrives, are equal; then, before the arrival of the event the expectation is worth half the money.—Expectation of life, the probable duration of the life of individuals of any given age. A rough estimate of anyone's expectation of life is made by calculating two-thirds of the difference between his or her present age and eighty.

EXPEC'TORANTS, in pharmacy, medicines which favor the discharge of mucus from the windpipe and air-passages of the lungs. Such are the stimulating gums and resins, squills, ipecacuanha, etc.

EXPER'IMENT, an operation designed to discover some unknown truth, principle, of effect, or to establish it when discovered. It differs from observation in the fact that the phenomena observed are, to a greater or less extent, controlled by human agency. Experiment distinguishes the modern method of investigating nature, and to it we owe the rapid strides made in chemistry, physics, etc.

EXPERT, a person eminently skilled in any particular branch or profession; specifically a scientific or professional witness who gives evidence on matters connected with his profession, as an analytical chemist or a person skilled in handwriting.

EXPERT TESTIMONY, in law, the testimony of expert witnesses, or, as they are commonly called, experts. The function of an expert witness is to examine a real or supposed case of facts and interpret them. They are called to give their testimony because, by reason of their special knowledge or skill in the matter in question, they are able to interpret or give accurate opinions concerning them where other men would not be qualified so to do. Their function is to give their opinions or judgments merely as witnesses of a matter of fact, actual or suppositious, presented to them, to aid the final judges of fact (the court or jury, as the case may be), but not to bind them. Notwithstanding the opinion either one way or the other of the expert witness employed to testify in any matter or proceeding at law, the final judgment as to the actual facts of the case, which shall be binding upon the parties to the litigation or proceeding, if for the jury, judge, or referee, as the case may be. The expert witness judges of the relation of the phenomena which he sees or perceives by his senses to the general rules of the science or art in which he is skilled or learned; but he has no part in the judgment as to the relation of the facts involved in the case to legal rules. He usually states what in his opinion would be a fact upon the supposition that certain other facts are true.

EXPLO'SION, a sudden bursting, generally due to the rapid production of

gaseous matter from solids to liquids. Thus the explosion of gunpowder is due to the sudden formation and expansion of gases into which the powder is converted by chemical agency. Explosions are often caused by the elastic force of steam confined in boilers, etc.

EXPLO'SIVES, are compounds practically available in war, in mining, and in general use for the sudden development of immense force. They comprise gunpowder, gun-cotton, nitro-glycerine with its compounds dynamite, litho-fracteur, etc.

EX POST FACTO, in law, by something done after and bearing upon something previously done; thus a law is said to be ex post facto, or retrospective, when it is exacted to punish an offense committed before the passing of the law.

EXPRESS', a special message, messenger, or conveyance, sent on a particular occasion. The name is given to any regular provision made for the speedy transmission of messages, parcels, commissions, and the like; and particularly to a railway train which travels at specially high rate of speed, stopping only at the principal stations.

EXPRESS, (1) Fast passenger service. The minimum standard of express trains in the U. States is about 40 miles an hour. An express on the New York Central road, running from New York to Buffalo, makes 440 miles in 6 hours and forty-seven minutes. On the Lake Shore and Michigan Southern, Buffalo to Chicago, 525 miles in seven hours and fifty minutes.

(2) Arrangements for fast conveyance of parcels. In continental Europe this service is performed by the post-office; in the United Kingdom mainly by the railways themselves, though the parcels-post is also well developed; in North America by companies specially organized for the purpose. The parcels express business was started by W. F. Harnden between Boston and New York in 1839, this forming the beginning out of which the Adams Express Company ultimately grew. The Wells-Fargo Express was started in 1845, and the American Express some five years later. Besides these the most important companies are the United States and the Southern.

EXPRESSED OILS, in chemistry, are those which are obtainable from bodies only by pressing, to distinguish them from mineral and essential oils, which last are, for the most part, obtained by distillation.

EX'TRACT, a term to denote all that can be dissolved out of a substance by a specified menstruum, such as water, alcohol, ether, etc. In modern pharmacy the term is applied to two kinds of preparation from vegetables. One is got by digesting the plant in water or other solvent, and evaporating or distilling away the excess of solvent until the extracted matter is sufficiently inspissated. The other is got by bruising the plant in a mortar, separating the juice, warming it until the green coloring matter separates, and filtering it off. The juice is next heated until the albumen coagulates, and again filtered. The juice is now evaporated to a syrup, the green coloring matter added and well mixed, and the evaporation is thereafter continued until the required concentration is attained. Extracts must be capable of being redissolved, so as to form a solution like that from which they were derived. Extracts are used in cookery, medicine, and the manufacture of perfumery.

EXTRACT OF MEAT, a preparation of beef, and sometimes of mutton, or of both combined, in which the muscular fiber, fat, and gelatin are removed, and the highly nitrogenous elements preserved and condensed into a semi-solid mass of about the consistence of ordinary butter. Most of what is sold in Europe and the U. States comes from Buenos Ayres, where its manufacture was first established under the supervision of the chemist Liebig.

Extract of meat is of variable quality and composition, and at the best but imperfectly represents the beef it was made from; some forms of it are stimulants merely. Nevertheless, it is useful in preparing soups, and especially in nourishing those who are sick of low fevers, pyæmia, and other like diseases.

EXTRADI'TION, the act by which a person accused of a crime is given up by the government in whose territories he has taken refuge to the government of which he is a subject. Treaties have been entered into by the U. States with almost all civilized countries for the apprehension and extradition of persons charged with particular offenses, such as murder, robbery, embezzlement by public officers, arson, rape, piracy, etc. The constitution of the U. States provides that "a person charged in any state with treason, felony, or other crime, who shall flee from justice and be found in another state, shall, on demand of the executive authority of the state from which he fled, be delivered up to be removed to the state having jurisdiction of the crime."

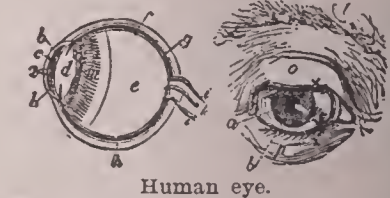
EXTRAVAGAN'ZA, in music, the drama, etc., a species of composition designed to produce effect by its wild irregularity and incoherence; differing from a burlesque in being an original composition and not a mere travesty.

EXTREME UNCTION has been, since the 12th century, one of the seven sacraments of the Catholic Church. It is performed in cases of mortal disease by anointing in the form of a cross, the eyes, ears, nose, mouth, hands, feet, and reins (in the case of males). It is administered after confession and the eucharist, and is believed to remove the last stains of sin. It can only be administered by a bishop or priest, and is not applied in the case of young children or excommunicated persons.

EXTREMITIES, the limbs, as distinguishing them from the other divisions of the animal, the head and trunk. The extremities are four in number, in man named upper and lower; in other animals anterior and posterior.

EYCK (ik), Hubert and Jan van, brothers, famous painters of the old Flemish school, born at Maaseyck, Hubert in 1366, Jan probably about 1390. They lived first at Bruges, whence the younger brother is called John of Bruges, and afterwards at Ghent, to which they removed about 1420. Here they executed the celebrated Adoration of the Lamb for the cathedral of Ghent; a painting which, in its different parts, contains above three hundred figures, and is a masterpiece. It was in two horizontal divisions, comprising ten panels, of which only the two central ones remain at Ghent, the others being at Berlin. Hubert did not live to see it completed. He died at Ghent (1426), as did also his sister Margaret, who was likewise a painter (1431). Jan finished the work in 1432, and returned to Bruges, where he remained till his death, which took place in 1441, and executed several excellent pieces. His reputation became very great even during his lifetime, by his share in the introduction of oil-painting, the original invention of which has been incorrectly ascribed to him by many. Jan van Eyck also introduced improvements in linear and aerial perspective, and in painting upon glass.

EYE, the visual apparatus of animals, consisting in man of the globe of the eye, the muscles which move it, and of its appendages, which are the eyelids and eyebrows, and the lachrymal apparatus. The walls of the globe of the eye are formed principally of two fibrous membranes; one white and opaque—the sclerotic (Gr. skleros, hard)—which envelops two-thirds of the globe posteriorly; and the other transparent, and resembling a horny plate, whence its name, cornea (Lat. corneus, horny). The sclerotic is a tough fibrous coat, and is the part to which the phrase "white of



Human eye.

Interior. *a*, Pupil. *b*, Iris. *c*, Cornea. *d*, Crystalline lens. *e*, Vitreous humor. *f*, Retina. *g*, Choroid coat. *h*, Sclerotic coat. *i i*, Central vein of the retina. *k*, Optic nerve. *m*, Ciliary processes. *n*, Ciliary ligament or circle.
Exterior. *l*, Eyebrow. *o p*, Upper and lower eyelid. *x x*, Eyelashes. The pupil and iris are also shown at *a* and *b* respectively.

the eye" is applied. In the front of the globe the sclerotic is abruptly transformed into the transparent portion (the cornea), which is circular and which forms a window through which one can see into the interior. A mucous membrane, the conjunctiva, so named because it unites the eye to the lid, spreads over the anterior portion of the globe, and then folds back on itself and lines the internal surface of the eyelids. On the internal surface of the sclerotic is a vascular membrane called the choroid. This is essentially the blood-vessel coat of the eyeball. The front part of the choroid terminates about the place where the sclerotic passes into the cornea in a series of ridges, the ciliary processes. The circular space thus left in front by the termination of the choroid is occupied by the iris, a round curtain, the structure seen through the cornea, differently colored in different individuals. In its center is a round hole, the pupil which appears as if it were a black spot. The iris forms a sort of transverse partition dividing the cavity of the eyeball into two chambers, a small anterior

chamber filled with the aqueous humor, and a large posterior chamber filled with vitreous humor. The iris consists of a framework of connective tissue, and its posterior surface is lined by cells containing pigment which gives the color to the eye. In its substance are bundles of involuntary muscular fibres, one set being arranged in a ring round the margin of the pupil, the other set radiating from the pupil like the spokes of a wheel. In a bright light the circular fibres contract and the pupil is made smaller; but in the dark these fibres relax and cause the pupil to dilate more or less widely, thus allowing only that quantity of luminous rays to enter the eye which is necessary to vision. Just behind the pupil is the crystalline lens, resembling a small, very strongly magnifying glass, convex on each side, though more so behind. The greater or less convexity of the surfaces of the lens determines whether the vision is long or short. The internal surface of the choroid, or rather the pigmentary layer which covers it is lined by the retina or nervous tunic upon which the objects are depicted that we see. It appears to be formed by the expansion of the optic nerve, which enters the eye at its posterior part about one-tenth of an inch to the inner side of the axis of the eyeball, and forms at the bottom of the globe an enlargement, which is called the papilla of the optic nerve. Microscopists describe the retina as being composed of five, or even eight layers, of which the internal one is vascular and in contact with the vitreous; the external one, very important in a physiological point of view, is the membrane of Jacob. It is composed of cones and cylinders or rods, joined together like the stakes of a palisade, perpendicular to the plane of the membrane, and forming by their free extremities a mosaic, each microscopic division of which is about 0·001 of a line in diameter according to Robin, and 0·0008 of a line according to Helmholtz; and represents a section of a rod. These rods and cones are believed to be the agents by whose aid the waves of light become transformed into the stimulus of a sensation. The ocular globe is put in motion in the orbit by six muscles, grouped two by two, which raise or lower the eye, turn it inward or outward, or on its antero-posterior axis. In these movements the center of the globe is immovable, and the eye moves round its transverse and vertical diameters. These three orders of movements are independent of each other, and may be made singly or in combination, in such a manner as to direct the pupil toward all points of the circumference of the orbit. Each eye is furnished with two eyelids, moved by muscles, which shield it from too much light and keep it from being injured. They are fringed with short fine hairs called eyelashes; and along the edge of the lids is a row of glands similar to the sebaceous glands of the skin. The eyebrows, ridges of thickened integument and muscle, situated on the upper circumference of the orbit and covered with short hairs, also regulate to some extent the admission of light by muscular contraction. In reptiles, some fishes (sharks, etc.), in birds and in some mammals a third eyelid or nictitating member is present, and can be drawn over the surface of the eye so as to clear it of foreign matters, and also to modify the light. The lachrymal apparatus is composed of, firstly, the lachrymal gland, which lies in a depression of the orbital arch; secondly, of the lachrymal canals, by which the tears are poured out upon the conjunctiva a little above the border of the upper lid; thirdly, the lachrymal ducts, which are destined to receive the tears after they have bathed the eye, and of which the orifices or lachrymal points are seen near the internal commissure of the lids; fourthly, the lachrymal sac, in which the lachrymal ducts terminate, and which empties the tears into the nasal canal. The tears, by running over the surface of the conjunctiva, render it supple and facilitate the movements of the globe and eyelids by lessening the friction. The influence of moral or physical causes increases their secretion, and when the lachrymal ducts do not suffice to carry them off they run over the lids.

Vision.—The retina renders the eye sensible of light, and we may therefore consider it as the essential organ of vision. The function of the other portions is to converge the luminous rays to a focus on the surface of the retina, a condition necessary for distinct vision and the clear perception of objects. The visual impressions are transmitted from the retina to the brain by means of the optic nerve, of which that membrane appears to be the expansion. The two optic nerves converge from the base of the orbit toward the center of the base of the skull, where there is an interlacement of their fibres in such a manner that a portion of the right nerve goes to the left side of the brain, and a part of the left nerve to the right side; this is called the chiasma or commissure of the optic nerves. The principal advantage of having two eyes is in the estimation of distance and the perception of relief. In order to see a point as single by two eyes we must make its two images fall on corresponding points of the retinas; and this implies a greater or less convergence of the optic axes according as the object is nearer or more remote. To accommodate the eye to different distances the lens is capable of altering itself with great precision and rapidity. When we look at a near object the anterior surface of the lens bulges forward becoming more convex the nearer the object; the more distant the object the more the lens is flattened. When the transparency of the cornea, the crystalline lens, or any of the humors, is destroyed, either partially or entirely, then will partial or total blindness follow, since no image can be formed upon the retina; but although all the humors and the cornea be perfectly transparent, and retain their proper forms, which is likewise necessary to distinct vision, yet, from weakness or inactivity of the optic nerve, or injury of the central ganglia with which it is connected, weakness of sight or total blindness may ensue. Defective vision may also arise from the crystalline lens being so convex as to form an image before the rays reach the retina (a defect known as short sight or myopia), in which case distinct vision will be procured by interposing a concave lens between the eye and the object of such a curvature as shall cause the rays that pass through the crystalline lens to meet on the retina; or the lens may be too flat, as in the case in old age, a defect which is corrected by convex lenses. In the lower forms of life the organs of sight appear as mere pigment spots. Ascending higher, simple lenses or refracting bodies occur. Insects, crustaceans, etc., have large masses of simple eyes or ocelli aggregated together to form compound eyes—the separate facets or lenses being optically distinct, and sometimes numbering many thousands. In the molluscs well-developed eyes approaching in structure those of the highest animals are found; and in all vertebrate animals the organ of vision corresponds generally to what has been described, though they vary much in structure and adaptation to the surroundings of the animal.

EYE-PIECE, in a telescope, microscope, or other optical instrument, the lens, or combination of lenses to which the eye is applied.

EZE'KIEL ("God shall strengthen"), the third of the great prophets, a priest, and the son of Buzi. He was carried away when young (about 599 B.C.) into the Babylonish captivity. His prophetic career extended over a period of 22 years, from the 5th to the 27th year of the captivity. The Book of Ezekiel contains predictions made before the fall of Jerusalem. 586 B.C. (chaps. I.-xxiv.); prophecies against some of the neighboring tribes (chaps. xxv.-xxxii.); prophecies concerning the future of Israel (xxxiii.-xxxix.); and a series of visions relating to the circumstances of the people after the restoration.

EZRA, a celebrated Jewish scribe and priest. Under his guidance the second expedition of the Jews set out from Babylon to Palestine under the reign of Artaxerxes I., about 458 B.C. The important services rendered by Ezra to his countrymen on that occasion, and also in arranging, and in some measure, it is believed, settling the canon of Scripture, are especially acknowledged by the Jews, and he has even been regarded as the second founder of the nation. Josephus states that he died in Jerusalem; others assert that he returned to Babylon, and died there at the age of 120 years. The Book of Ezra contains an account of the favors bestowed upon the Jews by the Persian monarchs, the rebuilding of the temple, Ezra's mission to Jerusalem, and the various regulations and forms introduced by him. It is written partly in Hebrew and partly in Chaldee, which have led some to conclude that it is the work of different hands.

F

F, the sixth letter of the English alphabet, is a labio-dental articulation, formed by the passage of breath between the lower lip and the upper front teeth. It is classed as a surd spirant, its corresponding sonant spirant being v, which is distinguished from f by being pronounced with voice instead of breath, as may be perceived by pronouncing ef, ev. (In if, of, however, f is = v.) The figure of the letter F is the same as that of the ancient Greek digamma, which it also closely resembles in power.

F, in music, is the fourth note of the diatonic scale.

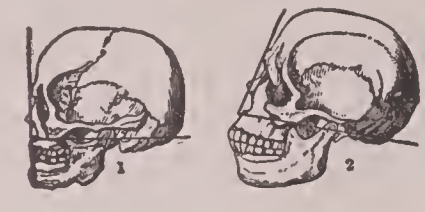
FA, the name given by Guido to the fourth note of the natural diatonic scale of C.

FABLE, in literature, a term applied originally to every imaginative tale, but confined in modern use to short stories, either in prose or verse, in which animals and sometimes inanimate things are feigned to act and speak with human interests and passions for the purpose of inculcating a moral lesson in a pleasant and pointed manner. The fable consists properly of two parts—the symbolical representation and the application, or the instruction intended to be deduced from it, which latter is called the moral of the tale, and must be apparent in the fable itself. The oldest fables are supposed to be the oriental; among these the Indian fables of Pilpay or Bidpai, and the fables of the Arabian Lokman, are celebrated. ((See Bidpai and Lòkman.) Among the Greeks, Æsop is the master of a simple but very effective style of fable. The fables of Phædrus are a second-rate Latin version of those of Æsop. In modern times Gellert and Lessing among the Germans, Gay among the English, the Spanish Yriarte, and the Russian Ivan Kriloff, are celebrated. The first place, however, among modern fabulists belongs to the French writer La Fontaine.

FACADE (fa-sād′ or fa-säd′), the face, front view, or principal elevation of a building. It usually contains the principal entrance.

FACE, the front part of the head, the seat of most of the senses. The bony basis of the face, exclusive of the thirty-two teeth (these not being in the strict sense bones), is composed of fourteen bones, called, in anatomy, the bones of the face. The anterior part of the skull also forms an important feature of the face. Of all these bones the lower jaw only is movable, being articulated with the base of the skull. The other bones are firmly joined together and incapable of motion. In brutes the jaws project much more than in men, and form the prominent feature of the face, while the forehead recedes. The face of birds comprehends the ophthalmic regions, cheeks, temples, forehead and vertex; the face of insects includes all between the proboscis and the prothorax.

FACIAL ANGLE, an angle of importance in the method of skull measurement introduced by Camper, the Dutch anatomist, who sought to establish a connection between the magnitude of this angle and the intelligence of different animals and men, maintaining that it is always greater as the intellectual powers are greater. Suppose a straight line drawn at the base of the skull, from the great occipita cavity, across the external orifice of the ear to the bottom of the nose, and another straight line from the bottom of the nose, or from the roots of the upper incisors, to the most prominent part of the forehead, then both



Facial angle.
1, European. 2, Negro.

lines will form an angle which will be more or less acute. In apes this angle is only from 45° to 60°; in the skull of a negro, about 70°; in a European, from 75° to 85°. In another mode of drawing the lines the angle included between them varies in man from 90° to 120°, and is more capable of comparison among vertebrate animals than the angle of Camper. This angle though of some importance in the comparison of races, is fallacious as a test of individual capacity.

FACIAL NERVE, a nerve of the seventh pair of cranial nerves, a motor nerve which supplies the muscles of expression on either side of the face. Paralysis of this nerve produces facial paralysis, the result of which is that the affected side is smooth, unwrinkled, and motionless, the eyelids are wide open and cannot be closed, and the muscles of the sound side having it all their own way drag the mouth to that side.

FACTOR, in arithmetic, the multiplier and multiplicand, from the multiplication of which proceeds the product; thus 7 and 4 are the factors of 28. In algebra any expression which is considered as part of a product is considered a factor.

FAC′TORY (from factor), a name which appears originally to have been given to establishments of merchants and factors resident in foreign countries; it now more commonly signifies a place in which the various processes of a particular manufacture are carried on simultaneously. The rapid growth of factories in this sense is a comparatively recent development of industry, resulting from the free use of machinery and the consequent subdivision of labor. Among the advantages of the factory system are generally counted: 1st, increased productiveness arising from the minute division of labor; 2d, the mechanical accuracy and the cheapness of the product turned out by machinery; 3d, the facilities for union and co-operation for common improvement afforded by bringing large masses of workmen together. But this last consideration is probably more than counterbalanced by the smaller amount of independent intelligence called forth in the individual worker, through the monotony of the minutely subdivided operations. Decided disadvantages of the factory system are the unhealthiness of the crowded rooms, where the air is full of deleterious elements; and the increasing demand on the labor of women and children, interfering as it does with the economy of domestic life.

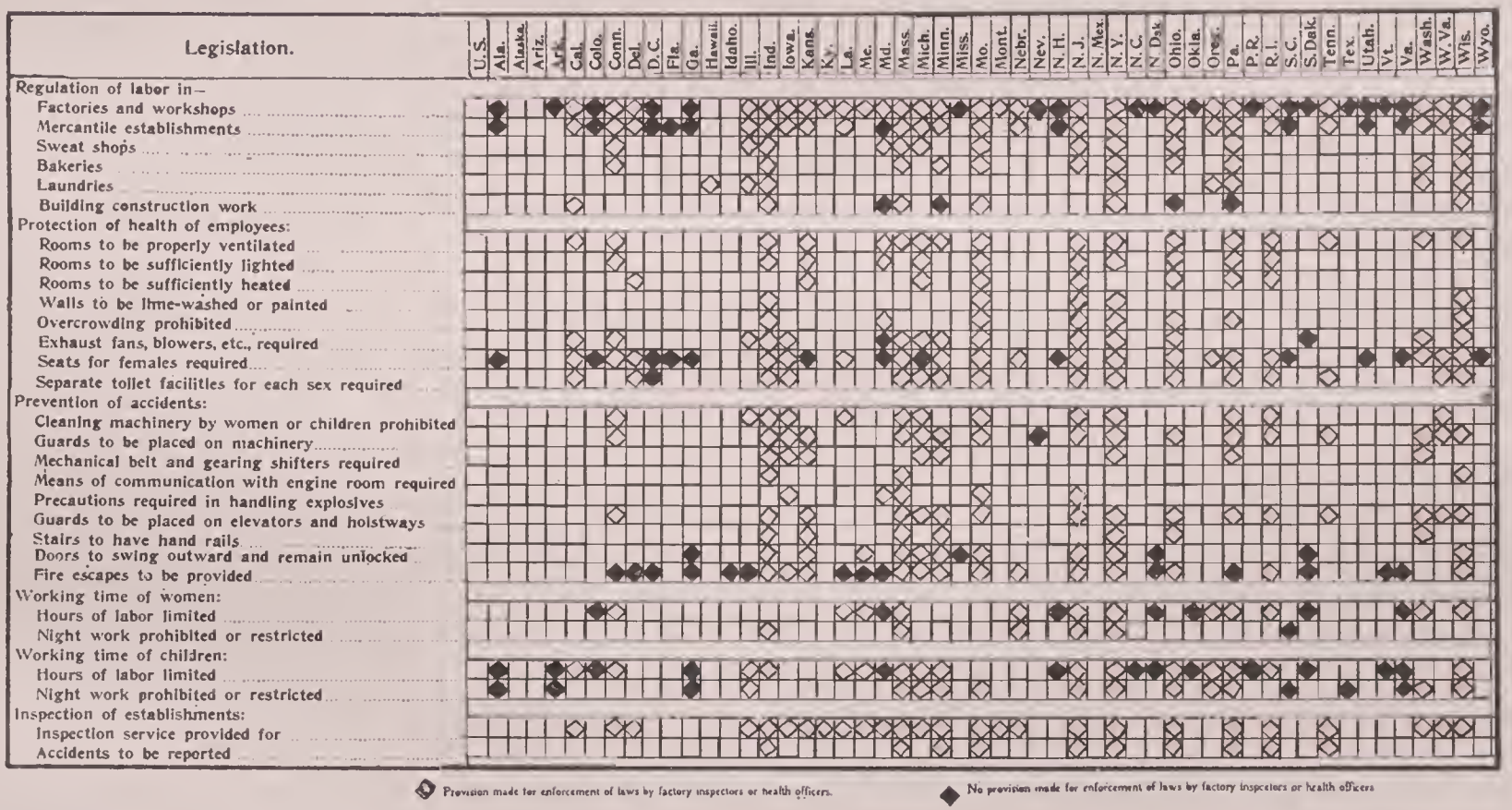
FACTORY ACTS, acts passed for the regulation of factories and similar establishments. Considering that women and children were not qualified fully to protect themselves against the strain of competition, the British legislature has passed a series of acts to regulate the conditions of their employment in factories. Various acts were passed up to 1878, when what is known as the Factory and Workshop Act was passed. It consolidates the previous series of statutes, and may be said to contain practically all the law dealing with the subject. It has general provisions regarding drainage, ventilation, and fencing of dangerous machinery, etc. In textile factories the hours of labor for women are restricted to ten, with Saturday for a half-holiday. The hours for children (those under fourteen years of age) are fixed at half of those allowed to women and young persons ("young persons" being defined as those between fourteen and eighteen). Provision is made for holidays and for attendance at school of children employed in factories. Special provisions for particular kinds of factories are made by separate acts, and under these the employment of females and young persons is regulated in bleaching and dyeing works, lace-factories, manufactories of earthenware, lucifer matches, percussion caps, cartridges, blast-furnaces, copper-mills, forges, foundries, manufactories of machinery, metal, india-rubber, gutta-percha, paper, glass, tobacco, letterpress printing, bookbinding, etc. In all the states of the American Union in which the factory is an industrial feature there is some legislation relative to the employment of women and children. Attention is given to the age of children employed, and attendance at public schools for a certain period each year is obligatory. The daily hours of labor are regulated. In some states the belting, shafting, etc., employed must be securely guarded. Penalties for violation of these provisions are designated.

FACULTY, the members taken collectively of the medical or legal professions; thus we speak of the medical faculty, etc. The term is also used for the professors and teachers collectively of the several departments in a university; as, the faculty of arts, of theology, of medicine, or of law.

FACULTY, in law, is a power to do something, the right to do which the law admits, or a special privilege granted by law to do something which would otherwise be forbidden.

FÆCES, the excrementitious part evacuated by animals. It varies of course with different species of animals,

LEGISLATION RELATING TO FACTORIES AND WORKSHOPS, MANUFACTURING ESTABLISHMENTS, ETC.



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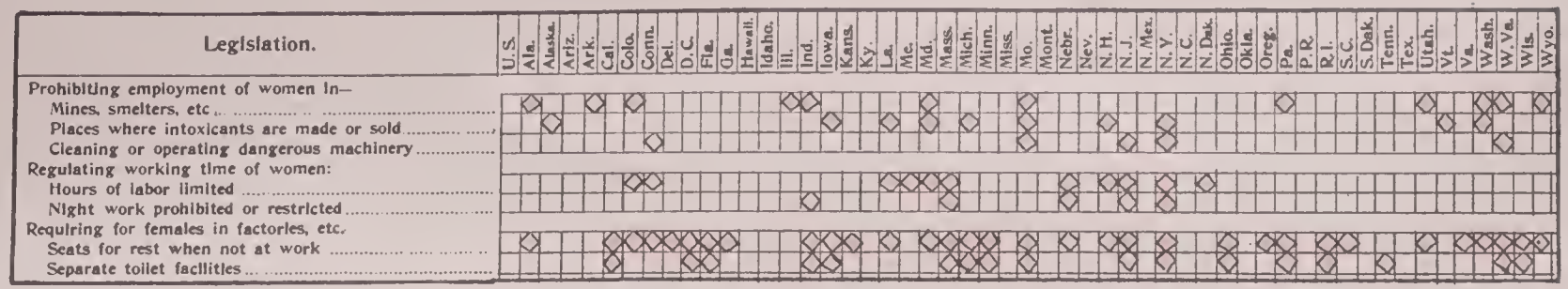
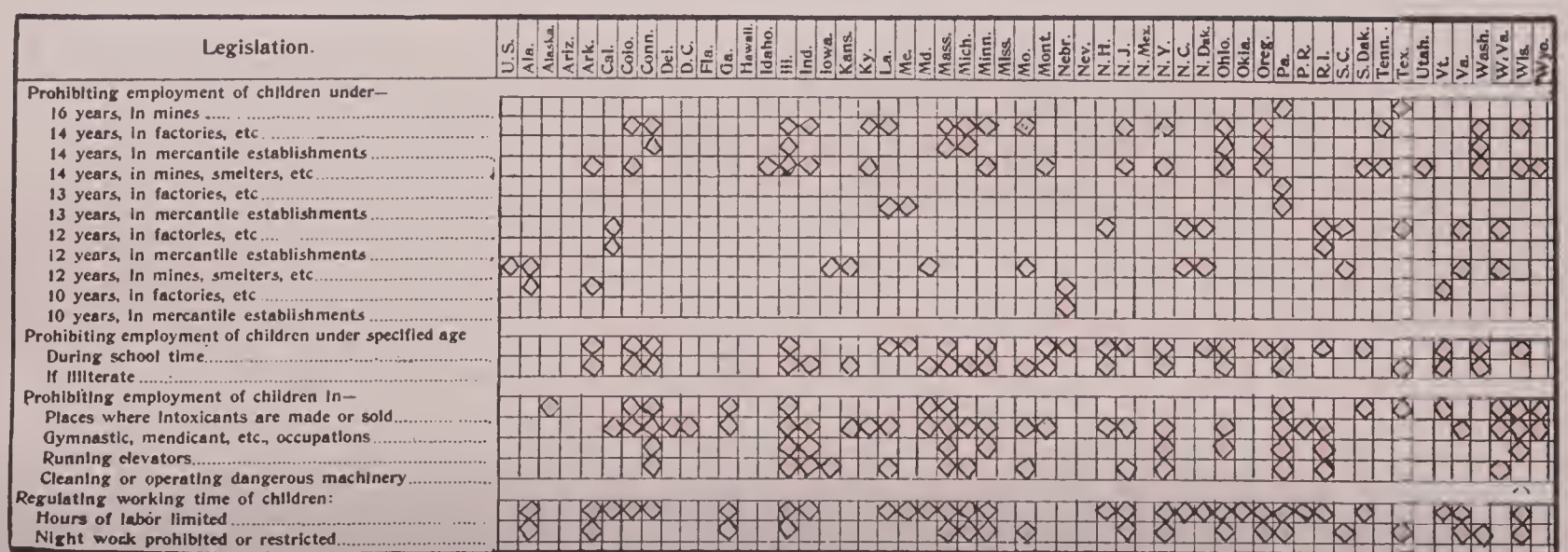


LEGISLATION RELATING TO CHILD LABOR



according to their diet. The main constituents are unassimilable parts of the food, on which the digestive process has no effect, ahd other portions, quite nutritious, but which have escaped digestion,. also certain waste matters, etc. In disease the composition varies extremely.

FAHRENHEIT, (fä'rên-hīt), Gabriel Daniel, German physicist, known for his arrangement of the thermometer, was born at Dantzig in 1686. Abandoning the commercial profession for which he had been designed, he settled in Holland to study natural philosophy. In 1720 he effected a great improvement by the use of quicksilver instead of spirits of wine in thermometers. He invented the Fahrenheit scale (see Thermometer), and made several valuable discoveries in physics. He died in 1736.

FAIENCE (fâ-yens'), imitation porcelain, a kind of fine pottery, superior to the common pottery, in its glazing, beauty of form, and richness of painting, and of which several kinds are distinguished by critics. It derived its name from the town of Faenza, in Italy, where a fine sort of pottery called majolica was manufactured as early as the 14th century. The majolica reached its greatest perfection between 1530 and 1560. In the Louvre, at Berlin, and at Dresden are rich collections of it. The modern faience appears to have been invented about the middle of the 16th century, at Faenza as an imitation of majolica, and obtained its name in France, where a man from Faenza, having discovered a similar kind of clay at Nevers, had introduced the manufacture of it. True faience is made of a yellowish or ruddy earth, covered with an enamel which is usually white, but may be colored. This enamel is a glass rendered opaque by oxide of tin or other suitable material, and is intended not only to glaze the body, but to conceal it entirely. See Pottery.

FAINTING, or syncope, a sudden suspension of the heart's action, of sensation, and the power of motion. It may be produced by loss of blood, pain, emotional disturbance, or organic or other diseases of the heart. It is to be treated by placing the patient on his back in a recumbent position or even with his head slightly depressed, sprinkling cold water on his face, applying stimulant scent to the nostrils, or anything which tends to bring back the blood to the brain. The admission of fresh cool air and the loosening of any tight article of dress are important.

FAIRBAIRN, Sir William, British civil engineer, born at Kelso, Roxburghshire in 1789. About 1831, his attention having been attracted to the use of iron as a material for ship-building, he built the first iron ship. He shares with Mr. Stephenson the merit of constructing the great tubular bridge across the Menai Strait. Fairbairn was one of the earliest members of the British association for the advancement of science, of which he was president in 1861–62. He was created a baronet in 1869. He died 18th August, 1874.

FAIRBANKS, Charles Warren, American statesman, was born in Union co., Ohio, in 1852. In 1874 he was admitted to the bar of the supreme court of Ohio at Columbus, and in the same year he removed to Indianapolis, Ind. In 1893 he was delegate at large to the Republican National Convention at St. Louis, in 1896, and was temporary chairman of the convention. He was appointed a member of the United States and British Joint High Commission which met in Quebec in 1898 for the adjustment of Canadian questions, especially referring to the seal fisheries of Alaska. He was elected to the U. States senate in 1897. In 1904 he was elected vice-president on the republican ticket.

FAIRBANKS, Thaddeus, American inventor, born in Brimfield, Mass., in 1796. In June, 1831, he patented the platform scales being his name. Afterward about fifty different improvements were made on these scales which have been sold in all parts of the world. He died in 1886.

FAIRCHILD, Charles Stebbins, American financier, born in Cazendria, N. Y., in 1842. He was admitted to the bar in 1865 and became deputy-attorney-general of New York in 1874, and attorney-general in 1876. He was assistant secretary of the treasury in 1857 to 1887, and secretary in 1887–9.

FAIRCHILD, Lucius, American soldier, born in Kent, Ohio, in 1831. At the beginning of the civil war he enlisted as a private in the federal army and in 1861 was appointed a captain in the regular army and major in the volunteer army. He took part in the battles of Bull Run and Antietam, and led the charge up Seminary Hill at Gettysburg. He was promoted brigadier-general in 1863 but resigned to become secretary of state of Wisconsin. He was afterward elected governor and served six consecutive terms. In 1886 he was chosen commander in chief of the Grand Army of the Republic. He died in 1896.

FAIRFAX, Thomas, Lord, a distinguished commander and leading character in the civil wars which distracted England in the 17th century. He was born in 1611, at Denton, in Yorkshire, being son and heir of Ferdinando, Lord Fairfax, to whose title and estates he succeeded in 1648. After serving in the Netherlands with some reputation he returned to England, and on the rupture between Charles I. and the parliament joined the forces of the latter. In 1642 he was appointed general of the horse, and two years later held a chief command in the army sent to co-operate with the Scots. In 1645, on the resignation of the Earl of Essex, Fairfax became general-in-chief of the parliamentary army. After the victory at Naseby he marched into the western countries, quelling all opposition, put down the insurgents in Kent and Essex in 1647, and captured Colchester. In April, 1649, he was occupied along with Cromwell in suppressing revolt in the army; but positively declined to march against the Scottish Presbyterians. He was a member of Cromwell's first parliament. He co-operated in the restoration of Charles II., being one of the committee charged to secure his return. He died at Nun Appleton, Yorkshire, 12th November, 1671.

FAIRIES, Elves, etc., imaginary supernatural beings or spirits supposed to have considerable influence for good or evil in the affairs of men. In the 12th century the poem of Lancelot of the Lake introduced the poetical treatment of the fairy world into France; and the fairies played at important part in the romantic works of the time. In the last part of the 17th century the true fairy tales first became popular, the Italians taking the lead in the Pentameron of Basilio. The fashion passed to France, where Perrault in 1697 published Contes de ma Mère l'Oye. Numerous imitations soon appeared. The best collections of later times have been those of the Brothers Grimm in German, and in English those of Keightley and Croker. As an original writer of fairy tales, Hans Christian Andersen, the celebrated Dane deserves particular mention.

FAIRS, periodical meetings of persons having goods or wares for sale in an open market held at a particular place, and generally for the transaction of a particular class of business. The origin of fairs is obviously to be traced to the convenience of bringing together at stated times the buyers and sellers of the stock-produce of a district. In Europe the numerous festivals of the church afforded the most favorable opportunity for the establishment of these markets. This association is indicated in the German name of a fair, which is identical with that used for the ceremony of the mass. In the middle ages fairs were of great importance, and were specially privileged and chartered by princes and magistrates, public proclamation being made of their commencement and duration. But modern facilities of communication have much diminished the necessity for periodical markets, and it is now chiefly among agriculturists that they are of much importance, large agricultural meetings being held in various districts for the sale of cattle and horses, and for the exhibition of agricultural implements. There are also, especially in Scotland, a considerable number of hiring fairs for farm-servants. In the less developed commerce of the east, however, they still retain much of their ancient importance and magnitude. In Europe the most important fairs of the present day are those at Leipzig, and Frankfort-on-the Main in Germany, at Lyons in France, and at Nijni-Novgorod in Russia. The latter is, indeed, the largest fair in the world. The fairs of Great Britain now mostly consist of the weekly market-days of country towns and the agricultural meetings already mentioned. In many places the old fair-days are still kept, but are now merely an assemblage of penny-theaters, peep-shows, and such amusements. In the U. States there are no fairs of the kind so common in the old world; the term is applied so a variety of exhibitions, especially of cattle and agricultural products. It also includes exhibitions and sales for religious and charitable purposes.

FAIRWEATHER, Mount, on the west coast of North America, in Alaska territory. It rises to the height of 14,900 feet, and is covered with perpetual snow.

FAITH, the assent of the mind to the truth of what is declared by another, resting on his authority and veracity, either without other evidence or on probable evidence of any kind. In a special sense the term faith is used for the assent of the mind to what is given forth as a revelation of man's relation to God and the infinite, i. e. a religious faith; and in Christian theology we have (1st) historical or speculative faith, or belief in the historic truthfulness of the Scripture narrative and the claims of Scripture to an inspired and supernatural origin: (2d) Evangelical or saving faith, that emotion of the mind (as Dwight defines it) which is called trust, or confidence exercised toward the moral character of God, and particularly of the Savior.

FAITH, Confession of. See Confession of Faith.

FAITH CURE, the curing or attempting to cure disease by appealing to the patient's faith. Also any cure supposed to have been effected by such means. The legal status of practitioners of faith cure—divine healing, faith healing, mental science, prayer cure, etc.—have in recent years arisen in different states but thus far no final determination of them has been reached.

FAKIRS (fā-kērz'), a kind of fanatics met with chiefly in India and the neighboring countries, who retire from the world and give themselves up to contemplation. They are properly of the Mohammedan religion, but the term is often used for a medicant of any faith. They are found both living in communities and solitary. The wandering fakirs gain the veneration of the lower classes by absurd penances and self mutilations.

FALCON (fa'kn), a name of various birds of prey. The falcons proper for strength, symmetry, and powers of flight are the most perfectly developed of the feathered race. They are distinguished

Peregrine falcon.

by having the beak curved from the base, hooked at the point, the upper mandible with a notch or tooth on its cutting edge on either side, wings long and powerful, the second feather rather the longest, legs short and strong. The largest European falcons are the jerfalcon or gyrfalcon proper, a native of the Scandinavian Peninsula, and the Iceland falcon, to which may be also added the Greenland falcon. Between these three species much confusion at one time prevailed, but they are now distinctly defined and described. In the Greenland falcon the prevailing color at all ages is white, in the Iceland falcon dark. The latter more nearly resembles the true gyrfalcon of Norway, which, however, is generally darker, rather smaller, but with a longer tail. The average length of any of these falcons is about 2 feet. The Greenland species used to be the most highly prized by falconers. Its food consists chiefly of ptarmigans, hares, and water-fowl. It is found over a wide range of northern territory. The peregrine falcon is not so large as the jerfalcon, but more elegant in shape. It chiefly inhabits wild districts, and nestles among rocks. It preys on grouse, partridges, ptarmigans, pigeons, rabbits, etc. Its flight is exceedingly swift, said to be as much as 150 miles an hour. The peregrine falcon was one of those most frequently used in falconry. Other British falcons are the hobby, formerly a great favorite for the chase of small game when falconry was in fashion; the merlin, small but swift and spirited; the kestrel, one of the most common British falcons. The term falcon is by sportsmen restricted to the female, the male,

Gerfalcon.

which is smaller and less courageous, being called tiercel, tersel, tercelet, or falconet.

FALCON'IDÆ, a family of birds of prey, in which the destructive powers are most perfectly developed. The family includes the different species of eagles as well as the hawks and falcons properly so-called, comprising the sub-families, buzzards, eagles, falcons, kites, hawks, and harriers.

FALCONRY (fä'kn-ri), the pursuit of game by means of trained falcons or hawks; also called hawking. Falconry is a very old amusement in Europe and Asia. In the middle ages it was the favorite sport of princes and nobles; and, as ladies could engage in it, it became very prevalent. Charlemagne passed laws in regard to falconry. In Germany Henry the Fowler and the Emperor Frederick the Second were much addicted to this sport, the latter having written a work on falconry. In France it reached its height under Francis I., whose grand falconer had under him an establishment of 15 nobles and 50 falconers. In Britain it was practiced among the Anglo-Saxons, but grew still more in favor after the Norman Conquest. In England the Duke of St. Albans is still hereditary grand falconer, and presents the king with a cast (or pair) of falcons on the day of his coronation. Falconry continued in favor till the 17th century; but the invention of fire-arms gradually superseded it, though in isolated instances gentlemen may be still be found who pursue the sport to some little extent. In Persia and other eastern countries hawking is still in great favor. The training of a hawk is a matter requiring great pains and pro-

Goshawk hooded for falconry.

tracted attention, the natural wildness and intractableness of the birds being difficult to overcome. When a hawk suffers itself to be hooded and unhooded quietly and will leap on the hand of the trainer to receive food, its education is considered far advanced, and the trainer now endeavors to accustom it to the lure. This may be a piece of leather or wood covered with the wings and feathers of a bird and attached to a cord. The falcon is fed from it, and is recalled by the falconer swinging the lure round his head with an accompanying cry. When it has been taught to obey the lure it is then practiced in the mode of seizing its game, which is first done with tame game attached to a peg. It is then made to fly at free game, and when it is fully trained it is used for sport. It is always kept hooded during excursions, until it is wanted to fly.

FAL'KIRK, a parliamentary burgh of Scotland, in Stirlingshire, 2½ miles west by north of Edinburgh. Falkirk is of great antiquity, and is associated with many remarkable historical events. In the neighborhood was fought the Battle of Falkirk in 1297 between Sir William Wallace and Edward I., the Scots, who were much inferior in numbers, being defeated. About 1 mile southwest from the town the Highlanders under Prince Charles defeated the royal forces under General Hawley, Jan. 17, 1746. Pop. 16,615.

FALKLAND, (fak'land), an ancient royal burgh of Scotland, county of Fife, 21 miles north of Edinburgh. It was once the residence of the Scottish kings, and possesses remains of an ancient palace and some curious old houses. There was formerly a castle here, in which David, eldest son of Robert III., was starved to death by order of his uncle the Duke of Albany, but no trace of it now remains. Pop. 972.

FALKLAND ISLANDS, an island group belonging to Great Britain, in the South Atlantic Ocean, about 300 miles east of the Straits of Magellan. They consist of two larger islands, East Falkland and West Falkland, containing respectively about 3000 and 2300 sq. miles, with a great number of smaller ones surrounding them; total area, 6500

sq. miles. They are hilly and boggy, entirely destitute of trees, but covered with a variety of grasses very nutritive for the sheep and cattle, the rearing of which is the principal industry. Fish and sea-fowl abound. The climate is equable and very healthy. The Falkland Islands were discovered by Davis on the 14th August, 1592. In 1710 a French vessel from St. Malo touched at them, and named them Isles Malouines. Settlements were afterwards formed on them by the French, Spaniards, and English alternately, but the latter have ultimately retained possession of them. The colony has a governor and other officers appointed by the crown. Port Stanley, in East Falkland, is a thriving settlement. Pop. of the group, 1800.

FAL'LACY, in logic, is when an argument is used as decisive of a particular issue, which in reality it does not decide. Properly a fallacy is a fault in the form of reasoning but the term is applied also to faults in the substance of the argument or proving one proposition by assuming another which is identical with it; or mistaking the point at issue; or arguing as if sequence were the same thing as cause and effect.

FALLING SICKNESS. See Epilepsy.

FALLING STARS. See Meteors.

FALL OF BODIES, all bodies on the earth, by virtue of the attraction of gravitation, tend to the center of the earth. A ball held in the hand presses downward; if dropped, it descends perpendicularly; if placed on an inclined plane, it rolls down, in doing which it presses the plane with a part of its weight. In the air bodies fall with unequal velocities, a piece of paper, for instance, more slowly than a ball of lead; and it was formerly thought that the velocity of the fall of bodies was in proportion to their weight. This error was attacked by Galileo, who, experimenting with balls of different substances which he dropped from the tower of Pisa, was led to the conclusion that the resistance of the air acting on different extents of surface was the cause of the unequal velocities, and that in a vacuum all bodies would fall with the same velocity. The truth of this last proposition was first demonstrated by Newton in his celebrated "guinea-and-feather" experiment, where a guinea-and feather are shown to fall side by side in the vacuum of the air-pump. This experiment proves that the force of gravitation in bodies is proportional to their inertia, that is to their mass. The laws of falling bodies, that is of bodies falling freely in a straight line and through a distance short in comparison with the earth's center, are the following:

1. When a body falls from rest it acquires velocity at the rate of about 32·2 feet per second. This number, which represents the acceleration due to the force of gravity, varies slightly with the locality, increasing from the equator to the poles, and diminishing as we recede from the center of the earth. At the end of five seconds therefore, the body would be found to be moving at the rate of 5 x 32·2, that is 161 feet per second.

2. The space fallen through in the first second is half of 32·2, that is 16·1 feet; and the space fallen through in any given time is found by multiplying the square of the number of seconds by 16·1. Thus, in three seconds a body falls 9 x 16·1 feet, or 144·9 feet.

3. The square of the velocity acquired by falling through any number of feet is found by multiplying twice that number by 32·2. Thus if a body falls 9 feet, the square of the velocity acquired is 2 x 32 x 9, or 576 feet per second, 32 being used instead of 32·2 and taking the square root of 576, we find that a velocity of 24 feet is acquired in a fall of 9 feet.

4. When a body is projected vertically upward with a given velocity, it continues to rise during a number of seconds found by dividing the number that expresses the velocity of projection by 32·2; and it rises to a height found by dividing the square of that number by 2 x 32·2, or 64·4.

FALL OF MAN, a commonly received doctrine of Christianity, founded upon the historical narrative contained in the third chapter of the book of Genesis, together with the allusions to the same matter in other parts of Scripture. Adam, having eaten of the forbidden fruit, is said to have fallen; and the relation of mankind in general to this fall is stated by St. Paul in the words: "By one man's disobedience many were made sinners" (Rom. v. 19). Thus, in the fall of Adam, all men are held to have fallen and to have contracted "original sin," alienating them from God and rendering them morally inadequate. The doctrine of the fall does not stand alone in Scripture. It is universally agreed by interpreters that in the original sentence pronounced on the transgressors there is contained the promise of a redemption, and that the whole scope of Scripture is directed to the development of this promise, and of the divine scheme of providence associated with it.

FALLOPIAN TUBES, in anatomy, are two ducts which open by one extremity into the womb, one at either angle of the fundus, and terminate at the other end in an open trumpet-shaped mouth, which at certain times grasps the ovary and receives the ovum. They are named after Fallopius or Falloppio, an Italian anatomist of the 16th century, who first recognized their functions.

FALLOW DEER, a European and Western Asiatic deer. It is smaller than the stag, of a brownish-bay color, whitish beneath, on the insides of the limbs, and beneath the tail. The horns, which are peculiar to the male, are very different from those of the stag; they are not properly branched, but are broader toward the upper part, and divided into processes down the outside. A simple snag arises from the base of each, and a similar one at some distance from the first. It was introduced at an early period into Britain.

FALLOWS, Samuel, clergyman, born at Pendleton, near Manchester, England 1835; removed with his parents to Wisconsin 1845; became a minister of the Methodist Episcopal Church; entered the army as chaplain 1861; afterward engaged in active military service; reached the rank of colonel and brevet brigadier-general; became rector of St. Paul's Reformed Episcopal Church, Chicago, 1875; editor-in-chief of the Appeal, the organ of the Reformed Episcopal Church, 1876; and was chosen a bishop of the Reformed Episcopal Church 1876, He has published a Supplemental Dictionary and Past Noon, and has edited many well-known books.

FALL RIVER, a city and port, Bristol co., Massachusetts, on an arm of Narraganset Bay and Taunton river, 53 miles s.s.w. of Boston. It is at the head of deep-water navigation, and the terminus of a line of steamers from New York. It contains several handsome streets, and has extensive cotton, woolen and calico-printing factories, iron-works, etc. Pop. 1909, 115,000.

FALSE IMPRISONMENT, the unlawful imprisonment or detention of any person. Every confinement of the person is imprisonment, whether in a common prison or a private house, or even by forcibly detaining one in the streets or highways. The law punishes false imprisonment as a crime, besides giving reparation to the party injured, through an action of trespass.

FALSE PERSONATION, all forms of false personation, for the purpose of obtaining the property of others, are punishable by the criminal law; as instances, the personation of the owner of any share, stock, or annuity, etc.; the false personation of voters at an election is a misdemeanor, the punishment of which is determined by state statute, involving fine, imprisonment, and deprivation of the rights of citizenship for a certain period.

FALSE PRETENSES, false representations and statements, made with a fraudulent design to otbtain "money, goods, wares, and merchandise," with intent to cheat. At common law a misdemeanor, punishable by statute.

FALSET'TO, applies in singing, to the notes above the natural compass of the voice. It is also called the head or throat voice, in contradistinction to the chest voice, which is the natural one. The falsetto voice is produced by tightening the ligaments of the glottis.

FAMILIAR SPIRITS, demons or evil spirits supposed to be continually within call and at the service of their masters, sometimes under an assumed shape, sometimes attached to a magical ring, or the like, sometimes compelled by magic skill, and sometimes doing voluntary service. We find traces of this belief in ages and countries, under various forms.

FAMILY, in zoological classifications, a group of individuals more comprehensive than a genus and less so than an order, a family usually containing a number of genera, while an order contains so many families. Family names usually terminnte in -idæ (after Latin patronymics, such as Æacidæ, sons or descendants of Æacus). In botany it is sometimes used as a synonym of order.

FAMINE, a dire want of food affecting considerable numbers of people at the same time. Irregular rainfalls in tropical climates, imperfect methods of irrigation, or, as in Ireland, the too exclusive dependence of the mass of people on a single article of food which happens to fail, are among the commonest causes of famines. In the early and mediæval ages they were frequent; but the rapidity of

modern communication and transport has made the rigor of famine almost impossible in Europe. In Ireland the years 1814, 1816, 1822, 1831, 1846, were marked by failure of the potato crop, and in the last-mentioned year the dearth was so great that ten millions were voted by parliament for relief of the sufferers. India has long been the seat of terrific famines; but of late the British officials have been very successful in organizing relief measures. Among the more recent are that in Northwest India (1899–00), in which above 800,000 perished; that in Bengal and Orissa (1865–66), when about a million perished; that in Bengal (1874), which was very successfully treated; that in Bombay, Madras, Mysore (1877), in which about half a million died. In China, a great famine took place in 1877–78, in which over nine millions are said to have perished; another took place in 1888–89 owing to the overflow of the Yellow river.

FAN, the name of various instruments for exciting a current of air by the agitation of a broad surface. (1) An instrument made of wood or ivory, feathers, thin skin, paper, variously constructed and mounted, and used by ladies to agitate the air and cool the face. As an article of luxury the fan was well known to the Greeks and Romans, They are said to have been introduced into England from Italy in the reign of Henry VIII. (2) Any contrivance of vanes or flat discs revolving by the air of machinery, as for winnowing grain, for cooling fluids, urging combustion, assisting ventilation, etc., is also so-called.

FANAT'ICISM is the term applied more particularly to the extravagance manifested in religious matters by those who allow themselves to be hurried away by their fancy and feelings, to the adoption not only of wild enthusiasitc views, but also of inordinate and not unfrequently persecuting measures, By an extension of the term it is also sometimes applied to other forms of extravagance.

FANCY, a term approaching imagination in meaning. In its general acceptation it refers both to the forms of the imagination and to the mental faculty which produces them; but it is used frequently for the lighter or more fantastic forms of the imagination, and for the active play of that faculty which produces them.

FANDAN'GO, an old Spanish dance, which originated most probably with the Moors in Andalusia. It is seldom danced but at the theater, and in the parties of the lower classes. It is danced by two persons only, who never touch so much as each other's hands; their reciprocal allurements, retreats, approaches, and varied movements, by turns pursuing and pursued, their looks, attitudes, and whole expression, are grossly indicative of voluptuousness.

FANEUIL HALL (fan'ū-il), a public building in Boston, famous as the place where stirring speeches were made at the outbreak of the war for American independence. It obtained the name "The cradle of American liberty." It was enlarged in 1805.

FANFARE, a short, lively, loud, and warlike, piece of music, composed for trumpets and kettle-droms. Also small, lively pieces performed on hunting-horns, in the chase.

FANNING ISLANDS, a group of coral islands in Central Polynesia between 1° 57′ and 5° 49′ n. lat., and between 157° and 162° w. lon.

FAN-PALM, a name sometimes given to the taliput palm, a native of Ceylon and Malabar It is also applied to the Mauritia palm, a tree which grows in great abundance on the banks of the Orinoco river in South America, and which yields the natives of these regions food, wine (made from its sap), and cordage, besides serving them for housing during the inundations to which the country is subject.

FAN-TAIL, a variety of the domestic pigeon, so called from the fan-like shape

Fantails.

of their tails. Also a name applied to certain Australian birds of the fly-catcher family.

FAN'TAN, In the American game a pack of 52 cards is used. The deal starts by cutting the cards. Ace high deals. The cards are then dealt to the left, one at a time. As many as eight persons may play. The cards remaining at the finish of the deal are dealt face down to the center of the table. The first player at the left of the dealer must have an ace to play, in which event he plays the ace to the center of the table. Having no ace, he must ante the amount agreed upon (usually 5 cents or less) to the center of the table, and draw one of the remaining cards. Thus the game proceeds until an ace can be played, after which the different stacks of cards are built up consecutively to the king. The first player ridding himself of his cards wins the pot. Failure to play a card in turn is punished by a fine equal to the amount of the ante for every card remaining in all of the player's hands.

FANTA'SIA, in music, a species of composition in which the author ties himself to no particular theme, ranging as his fancy leads him amid various airs and movements.

FAN-TRACERY, in architecture, elaborate geometrical carved work, which spreads over the surface of a vaulting, rising from a corbel and diverging like the folds of a fan. Fan-tracery vaulting is much used in the Perpendicular style, in which the vault is covered by ribs and veins of tracery, of which all the principal lines diverge from a point, as in Henry VII.'s chapel, Westminster.

FAR'ADAY, Michael, one of the greatest of English chemists and physicists, was born in humble circumstances at Newington Butts, near London, on the 22d September, 1791. Early in life he was apprenticed to a bookbinder in London, but occupied himself at his leisure hours with electrical and other scientific experiments. Having been taken by a friend to Sir Humphrey Davy's lectures he attended the course, and conceived such an ardent desire for study that he resolved to quit trade. With this end he sent his notes of the lectures to Sir Humphrey Davy, who was so struck with the great ability they showed that

Fan-tracery vaulting, Beauchamp chapel, Warwick.

he appointed him his assistant at the Royal Institution. In 1829 he became lecturer at the Royal Military Academy at Woolwich, and in 1833 he was appointed to the newly-established chair of chemistry at the Royal Institution. It was while in this office that he made most of his great electrical discoveries. His communications to the Philosophical Transactions have been published separately in three vols. (1839, 1844, 1855). In 1832 he received the honorary

Fan-tracery, Cloisters of Gloucester cathedral, England.

degree of D.C.L. from Oxford, was made an honorary member of the Academy at Berlin, with many other honors too numerous to mention. He died Aug. 25, 1867. As an experimentalist Faraday was considered the very first of his time. As a popular lecturer he was equally distinguished, and even used to draw crowds to the Friday evening lecture at the Royal Institution. Among his published works we may mention the fol-

lowing: Researches in Electricity (1831–55), Lectures on Non-metallic Elements (1853), Lectures on the Forces of Matter (1860), Lectures on the Chemical History of a Candle (1861).

FARALLO'NES, a group of small islands in the Pacific, about 30 miles from the entrance to the Bay of San Francisco.

FARCE, a dramatic piece of low comic character. It is grotesque and extravagant rather than artistically humorous.

FARCY, a disease to which horses are liable, intimately connected with glanders, the two diseases generally running into each other. It is supposed to be a disease of the absorbents of the skin, and its first indication is generally the appearance of little tumors called farcy buds on the face, neck, or inside of the thigh.

FARDEL-BOUND, a term applied to cattle and sheep affected with a disease caused by the retention of food in the maniplies or third stomach, between the numerous plaits of which it is firmly impacted. Over-ripe clover, vetches, or rye-grass are liable to produce the disease.

FARGO, a city and railway center, the capital of Cass co., N. Dak., situated on the Gt. Northern, C., M. and St. P., and Northern Pacific railways, and on the west bank of the Red river of the North; at the head of navigation, opposite Moorehead, Minn. It is one of the most important markets for wheat and farm machinery in the Northwest. Pop. 11,362.

FARIBAULT (fār-i-bō'), a city and railway center, the capital of Rice co., Minn., situated at the confluence of Straight and Cannon rivers; 53 miles s. of St. Paul. Pop. 10,160.

FARIDPUR (fa-rēd-pōr'), a district of India, in the Dacca Division of Bengal; area, 2276 sq. miles; pop. 1,631,734 Chief town, Faridpur, on the Marā Padmā. Pop. 10,263.

FARI'NA, a term given to a soft, tasteless, and commonly white powder, obtained by trituration of the seeds of cereal and leguminous plants, and of some roots, as the potato. It consists of gluten, starch and mucilage.

FARI'NI, Luigi Carlo, an Italian statesman and author, born in 1812. He became known as a nationalist and patriot in the political movements of 1841, had to leave the country for a time, but returned and was made a member of the reform ministry at Rome during the disturbances of 1848. After the peace of Villafranca he was chosen dictator of the duchies of Parma and Modena, and was mainly instrumental in inducing them to unite with the Piedmontese monarchy. His History of the Papal States from 1814 to 1850 is well known. In 1862 he became president of the ministry, lost his reason in 1863, and died 1st August, 1866.

FARMERS-GENERAL, private contractors, to whom under the old French monarchy was let out the collection of various branches of the revenue, poll-tax, duties on salt and tobacco, customs, etc. These contractors made enormous profits on the farming of the public revenues. A revenue collected in this way not only imposed a much heavier burden on the people but the merciless rigor of irresponsible and uncontrolled exactors subjected them to hardships and indignities to which they could not submit without degradation. In 1790 the system was suppressed by the constituent assembly.

FARMERS' INSTITUTES, gatherings of farmers held annually in the various states. The object of these institutes is the bringing together the workers in agricultural science and the practical farmers for the discussion of questions of mutual interest. The growth of farmers' institutes has been largely owing to the impetus given to the agricultural interests by the Morrill Land Grant Act of 1862. Gatherings are held in over 40 states, generally in the winter when the farmers are free to attend them.

FARMING. See Agriculture.

FARNE (or Ferne) **ISLANDS,** a group of islets, England, in the German Ocean off the north coast of Northumberland, 2 miles e. by s. of Bamborough Castle, and separated from the mainland by a channel of about 1¾ mile. They have been the scene of several disastrous shipwrecks.

FARO, or **PHARO,** a game of hazard at cards, played chiefly in gambling establishments, and in which the player plays against the bank, represented by a professional faro-banker.

FARO, a promontory forming the northeast point of Sicily at the entrance to the Strait of Messina. The point is strongly fortified, and on it there is a lighthouse 200 years old.

FAROE ISLANDS (fā'rō), a group of islands in the North Atlantic, lying between Iceland and Shetland. They belong to Denmark, and are twenty-five in number, of which seventeen are inhabited. The inhabitants are chiefly engaged in fishing and the rearing of sheep. Thorshavn, in Strömö, the largest island, is the seat of government. Pop. 12,965.

FAR'RAGUT, David Glasgow, admiral of the U. States, was born in 1801, and entered the navy as midshipman at the age of 9½. In 1821 he was promoted to a lieutenancy, and was actively engaged in his profession up till 1851, when

David G. Farragut.

he was oppointed assistant inspector of ordnance. In 1855 he received a commission as captain. In 1861 he was assigned to go with the expedition against New Orleans, undertaken on the formation of the confederacy, and sailed in February of the following year. New Orleans surrendered to the combined attack of the land and naval forces on 25th April, and Farragut proceeded to Vicksburg, running past successfully. In consequence of his success at New Orleans he was promoted to the rank of rear-admiral. In 1863 Farragut attempted to pass the batteries of Port Hudson, but was unsuccessful. In August, 1864, he attacked the confederate fleet in the bay of Mobile, and forced it to surrender, thus making the fall of Mobile merely a question of time. July 25, 1866, he was made admiral, a grade which had not hitherto existed in the U. States navy. He died 14th August, 1870.

FARRAR, Frederic William, The Ven., D.D., F.R.S., born in Bombay, Aug. 7, 1831. He has published several popular theological works and works of fiction, and is known as a popular lecturer. He was Bampton Lecturer in 1885. Among his principal works are: The Life of Christ, Life of St. Paul, The Early Days of Christianity, Lives of the Fathers. He died in 1903.

FARRIERY. See Veterinary Art.

FARS, or **FARSISTAN,** a maritime province in the southwest of Persia, abutting on the Persian Gulf. The manufactures include woolen, silk, and cotton goods; and in these and other articles an active trade is carried on, chiefly with Hindustan. Pop. estimated at 1,700,000.

FARTHING, the fourth part of a penny; the modern form of the Anglo-Saxon feorthung, the fourth part of anything.

FARTHINGALE, or **FARDINGALE,** an article of ladies' attire worn in the days of Queen Elizabeth, and closely resembling the modern crinoline. It was formed of circles of whalebone hoops, and protruded more at the waist than the modern crinoline.

FARUKHABAD, or **FARRAKHABAD** (far-ak-ā-bad'), a city in the northwest Provinces of British India, 2 or 3 miles from the Ganges, a handsome well-built town, with avenues of trees in many of its streets. Pop. 78,032.

FASCES (fas'sēz), among the ancient Romans, a bundle of polished rods, in the middle of which was an axe, carried by lictors before the superior magistrates. The number of fasces and lictors varied with the dignity of the magistrate. In the city the axe was laid aside.

FASCINATION, the exercise of an overpowering and paralyzing influence upon some animals attributed to certain snakes corresponding somewhat to the so-called evil-eye among human beings. Squirrels, mice, and the smaller birds are said to be the most subject to this power; but the fact is far from clearly explained, and is not perhaps even sufficiently demonstrated. Most of the accounts agree in describing the animal fascinated as having a painful consciousness of its danger, and the power exercised over it, but to be unable to resist the desire to approach the fascinator. Some have endeavored to explain this power as the effect of narcotic emanations from the serpent which stupefy the weaker animal. Others regard it as bearing as striking analogy to the mesmeric influence which one human being sometimes has over another.

FASCINES, (fa-sēnz'), in the miliatry art, bundles of boughs or rods from 6 to 18 feet in length and usually 1 foot in diameter, used in raising batteries, strengthening parapets, revetting slopes etc. The twigs are drawn tightly together by a cord, and bands are passed round them at the distance of 2 feet from each other. Very long thin ones are called saucissons or battery-sausages.

FASHODA, a large town built by the Egyptians in 1867 on the banks of the Nile in the Soudan, n. lat. 10°. It gives its name to that portion of the district. Since 1884 it has been in ruins, the Mahdi overthrowing Egyptian rule in that year. In 1898 Marchand, a French adventurer, hoisted the French flag there, but was ousted by the Anglo-Egyptian Sirdar, General Herbert Kitchener.

FASTING, the partial or total abstinence of mankind and animals from the ordinary requisite supply of aliment, by which it is to be understood that quantity which is adapted to preserve them in a healthy and vigorous condition. It would appear that various warm blooded animals are capable of sustaining total abstinence much longer than human beings. Cats and dogs have survived for several weeks without nourishment of any kind, but it is probable that few human beings could survive such deprivation for more than a week. The use of water without solid food enables life to be sustained much longer than it could otherwise be.

FASTS, temporary abstentions from food, especially on religious grounds. Abstinence from food, accompanied with signs of humiliation and repentance or grief, is to be found more or less in almost all religions. Among the Jews fasts were numerous, and we find many instances of occasional fasting in the Old Testament. Herodotus says that the Egyptians prepared themselves by fasting for the celebration of the great festival of Isis. So in the Thesmophoria at Athens, and in the rites of Ceres at Rome, it was practiced. The Church of Rome, distinguishes between days of fasting and of abstinence. The former are: 1, the forty days of Lent; 2, the Ember days, being the Wednesday, Friday, and Saturday of the first week in Lent, of Whitsun week, of the third week in September, and of the third week in Advent; 3, the Wednesdays and Thursdays of the four weeks in Advent; 4, the vigils or eves of Whitsuntide, of the feasts of St. Peter and St. Paul, of the Assumption of the Virgin, of All Saints, and of Christmas Day. When any fasting days fall upon Sunday it is observed on the Saturday before. The Greek Church observes four principal fasts: that of Lent, one beginning in the week after Whitsuntide, one for a fortnight before Assumption, one forty days before Christmas. In the East, however, the strict idea of a fast is more preserved than in the West.

FAT, an oily concrete substance, a compound of carbon, hydrogen, and oxygen, deposited in the cells of the adipose or cellular membrane of animal bodies. In most parts of the body the fat lies immediately under the skin. Fat is of various degrees of consistence, as in tallow, lard and oil. It is generally white or yellowish, with little smell or taste. It consists of two substances, stearine and elaine or oleine, the former of which is solid, the latter liquid. These elements are separated by pressing the fat between folds of bibulous paper, which absorbs the liquid or oil. By after-treatment with water the oil is separated from the paper. Fats are insoluble in water. When boiled with caustic alkalies they are decomposed (saponification yielding an alkaline salt of the fatty acid (soap) and glycerine. Human fat appears to contain no stearine, but margarine and oleine. It is an excellent packing material in the body, and gives the human frame its smooth rounded contour. Being a bad conductor of heat, it is useful in retaining warmth, but its chief function is that of nutrition.

FA'TALISM, the belief in fate, or an unchangeable destiny, to which everything is subject, uninfluenced by reason, and pre-established either by chance or the Creator. Among notable historical examples of the belief in fate may be mentioned the old Greek conception of a fate which stood behind the gods themselves as a controlling power; the Mohammedan fatalism, which regards all things great and small as inexorably predetermined, so that no accident is possible; the theological doctrine of predestination among Calvinists. See Predestination.

FATEHPUR (fat-e-pör'), Indian town in district of the same name, Allahabad division, Northwest Provinces, 50 miles s.e. of Cawnpore. Pop. 21,328. The district was an area of 1639 sq. miles, and a pop. of 683,745.

FATES, in Greek and Latin mythology, the inexorable sisters who spin the thread of human life. The appellation Clotho (the spinner) was probably at first common to them all among the Greeks. As they were three in number, and poetry endeavored to designate them more precisely, Clotho became a proper name, as did also Atropos and Lachesis. Clotho means she who spins (the thread of life); Atropos signifies unalterable fate; Lachesis, lot or chance; so that all three refer to the same subject under different points of view. They know and predict what is yet to happen. Lachesis is represented with a spindle, Clotho with the thread, and Atropos with scissors, with which she cuts it off. We find also in the northern mythology three beautiful virgins, the Nornen, who determine the fate of men. Their names are Urd (the past), Varande (the present) and Skuld (the future).

FATHERS OF THE CHURCH, or **CHRISTIAN FATHERS.** See Church, Fathers of the.

FATHOM, a unit of length equal to 6 feet. It is chiefly used by sailors, who measure soundings, etc., in fathoms.

FAT'IMITE DYNASTY, a line of caliphs claiming descent from Fatima, the favorite daughter of Mohammed, and of Ali her cousin, to whom she was married. In the year 909 Abu-Mohammed Obeidalla, giving himself out as the grandson of Fatima, endeavored to pass himself off as the Mahdi or Messiah predicted by the Kora. Denounced as an imposter by the reigning caliph of Bagdad he fled into Egypt, became caliph of Tunis, and soon conquered all Northern Africa from the Straits of Gibraltar to the borders of Egypt. His son wrested Egypt from the Abbasides in 970 and founded Cairo. The Fatimite dynasty was extinguished on the death of Adhed, the fourteenth cailph, and a new line began with Saladin.

FATTY ACIDS, a name given to such acids as have been separated from fats. Fats and fixed oils are composed of one or more acids combined with the radical glyeyl. By boiling with potash or soda the fat is decomposed, glycerin and a soap being the products. By treating this soap with hydro-chloric or sulphuric acid the base is removed and the fatty acid obtained free. These acids are such as butyric, caproic, steraic, margaric, palmitic, pelargonic, valerianic, acteic, etc. Formic acid has also been included, in the fatty series of acids, as it belongs to the same order as those named.

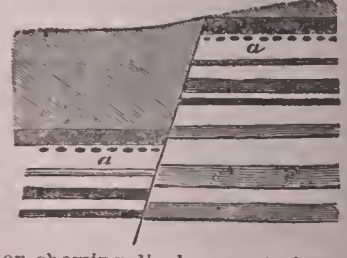
FATTY DEGENERATION, an abnormal condition found in the tissues of the animal body, in which the healthy protoplasm is replaced by fatty granules. It is a sign of defective nutrition, and is common in old age, affecting the muscles the heart, the arteries, kidneys, etc. It is accompanied by great muscular flabbiness and want of energy, the sufferer looking at the same time fat and comparatively well.

FATTY TISSUE, in anatomy, the adipose tissue, a tissue composed of minute cells or vesicles, having no communication with each other, but lying side by side in the meshes of the cellular tissue, which serves to hold them together, and through which also the blood-vessels find their way to them. In the cells of this tissue the animal matter called fat is deposited.

FAUBOURG (fō-bör), a suburb of French cities; the name is also given to districts now within the city, but which were formerly suburbs without it. Thus the Faubourg St. Germain is a fashionable quarter of Paris in which the ancient nobility resided.

FAU'CET, a form of valve or cock in which a spigot or plug opens or closes a part of a pipe for the passage of liquid.

FAULT, in geology, a fracture of strata, accompanied by a sliding down or an upheaval of the deposits on the one side of the fracture to a greater distance



Section showing displacement of strata by a fault. *a* and *a* were once a continuous mass of rock.

than the other. Faults are frequently met with in coal-beds, the miner coming unexpectedly upon an abrupt wall of other strata. The angle this makes with the plane of the bed he is working indicates whether he must look up or down for its continuation on the other side of the fracture. In mines these faults often

serve for natural drains. The cut shows at a a the change of position in strata caused by a fault.

FAUNA, a collective word signifying all the animals of a certain region, and also the description of them, corresponding to the word flora in respect to plants.

FAURE, François Felix, (fräṅ-swa-fā-lēks fōr) French president, born in Paris in 1841. During the Franco-Prussian war he commanded a body of volunteers and gained the ribbon of the Legion of Honor. He entered the assembly in 1881, served as colonial and commerical minister in the cabinets of Gambetta, Jules Favre, and Tirad, and as minister of marine in that of Dupuy. He was elected president of the republic in 1895 He died in 1899.

FAUST, Doctor John, a celebrated dealer in the black art, who lived in Germany, early in the 16th century. According to some accounts he was born in Suabia, others make him a native of Anhalt, others of Branndenburg. In his sixteenth year he went to Ingolstadt and studied theology, became in three years a magister, but abandoned theology, and began the study of medicine, astrology, and magic, in which he likewise instructed his familiar Johann Wagner, the son of a clergyman at Wasserburg. After Dr. Faust had spent a rich inheritance, he, according to tradition, made use of his power to conjure up spirits, and entered into a contract with the devil for twenty-four years. A spirit called Mephistophles was given as a servant, with whom he traveled about, enjoying life in all its forms, but the evil spirit finally carried him off. Even yet Dr. Faustus and his familiar Wagner play a conspicuous part in the puppet-shows of Germany, and the legend forms the subject of Goethe's great drama Faust, and furnishes the libretto for Gounod's famous opera of the same name. As early as 1590 the legend was dramatically treated in England by Christopher Marlowe.

FAVART (fā-vär), Charles Simon, creator of the serio-comic opera in France, born 1710, was the son of a pastry-cook. His poetical reputation rests principally on his numerous productions for the opera aux Italiens, and the comic opera. He was the director of a company of itinerant actors which followed Marshal Saxe into Flanders. His wife, Madame Favart, was a famous singer, comic actress, and dancer, and participated in the composition of her husband's plays. Favart died in 1792.

FAVRE (fävr), Jules, a French politician, born 21st March, 1809, at Lyons. He was a leader of the party of opposition to the President Louis Napoleon; and after the coup d'état (1851) he retired from political life for six years, till in 1858 his defense of Orsini for the attempt on the life of the emperor again brought him forward. From this time he again became an active leader of the republican opposition to the emperor. On the fall of the empire he became vice-president of the government of national defense and minister of foreign affairs. As such he conducted the negotiations for peace with Prince Bismarck. But though he showed great energy and was very eloquent, his operations both in the matter of the armistice and the peace showed a lack of skill and judgment. He died in 1880.

FAWKES, Guy. See Gunpowder Plot.

FAYAL (fī-ål'), an island belonging to Portugal, one of the Azores. It is of a circular form, about 10 miles in diameter The climate is good, and the air always mild and pure. The soil is very fertile, producing in abundance wheat, maize, flax, and almost all the fruits of Europe. It exports a great quantity of oranges and lemons. The chief place is Villa Horta or Orta. Pop. 31,000.

FAYENCE. See Faience.

FAYETTE, General La. See Lafayette.

FAYOUM (fā-yöm'), a province of Middle Egypt, a little to the west of the Nile, surrounded by the Libyan desert; area about 800 sq. miles. On the west lies Lake Birket-el-Kurun. The chief town, Medinet-el-Fayoum, is connected with Cairo by a railway. Pop. of province, 228,709.

FEASTS. See Festivals.

FEATHER-GRASS, the popular name of a plant, a native of dry places in the south of Europe. The leaves are rigid, setaceous, grooved; the awns exceedingly long, feathering to the point. It is a great ornament to gardens in summer, and to rooms in winter. The rush-leaved Feather-grass is found in the prairies of the Western States.

FEATHERS, the form which the dermal appendages assume in birds, agreeing in mode of development, but differing in form from hair and scales. The leather consists of a stem, horny, round strong, and hollow in the lower part, called the quill, and in the upper part, called the shaft, filled with pith. On each side of the shaft is a web composed of a series of regularly-arranged fibres called barbs. The barbs and shaft constitute the vane. On the edges of the barbs are set the barbules, which interlock with those of adjacent barbs, and thus give strength at the vane. Feathers are generally divided into two kinds, quill feathers in the wing or tail, and plumes or clothing feathers generally diffused. The feathers of birds are periodically changed, generally once, but in some species twice a year. This is called moulting. When feathers have reached their full growth they become dry, and only the tube, or the vascular substance which it contains, continues to absorb moisture or fat. When, therefore, part of a feather is cut off, it does not grow out again; and a bird whose wings have been clipped remains in that situation till the next moulting season, when the old stumps are shed and new feathers grow out. If, however, the stumps are pulled out sooner (by which operation the bird suffers nothing), the feathers will be renewed in a few weeks or even days. The feather is a very strong formation, not readily damaged the arch of the shaft resisting pressure, while the web and fine fibers yield without suffering. Being a bad conductor of heat it preserves the high temperature of the bird, while it is so light as to be easily carried in flight. It is rendered almost impervious to wet by the oily fluid which most birds secrete at the base of the tail. Feathers form a considerable article of commerce, particularly those of the ostrich, heron, swan, peacock, goose, etc., for plumes, ornaments, filling of beds, pens, etc.

FEATHER-STAR, a beautiful crinoid star-fish occurring on the British coasts, consisting of a central body or disc, from which proceed five radiating arms, each dividing into two secondary branches, so that ultimately there are ten slender rays. Each arm is furnished on both sides with lateral processes so as to assume a feather-like appearance. It is fixed when young by a short stalk, but exists in a free condition in its adult state.

FEB'RIFUGE, a medicine employed to drive off or diminish fever, such as quinine.

FEB'RUARY (from the Roman Februa, a festival of expiation or purification), the second month in the year, having twenty-eight days, except in leap-year, when it has twenty-nine. This latter number of days it had originally among the Romans, until the senate decreed that the seventh month should bear the name of Augustus, when a day was taken from February and added to August to make it equal to July in number of days.

FEDERAL GOVERNMENT, government by the confederation of several united states, self-governing in local matters, but subject in matters of general polity to a central authority, as, for instance, the Swiss Republic, the U. States of North America, Mexico, etc. The degree to which such states give up their individual rights as sovereign bodies may be very different.

FEDERAL PARTY, a name assumed by that portion of the people of the U. States who favored the adoption of the federal constitution, organized the government and administered it for twelve years. They advocated a government having attributes of sovereignty, operating upon the people directly, and having all necessary powers for effective action; their opponents favored a simple compact of confederation.

FEE, or FIEF, in law, primarily meant a loan of land, an estate held in trust on condition of the grantee giving personal or other service to the prince or lord who granted it. Feudal estates, however, soon came to be regarded as inalienable heritages held on various tenures; hence the term fee came to be equivalent to an estate of inheritance, that is an interest in land which passes to heirs if the owner die intestate. The amplest estate or interest in land is that of a fee-simple, which is also called an absolute fee, in contradistinction to a fee limited or clogged with certain conditions. A fee-simple means the entire and absolute possession of land, with full power to alienate it by deed, gift, or will. It is the estate out of which other lesser estates are said to be carved; such as fee-tail, which is limited to particular heirs, and subject to certain restrictions of use; and a base fee, which ceases with the existence of certain conditions.

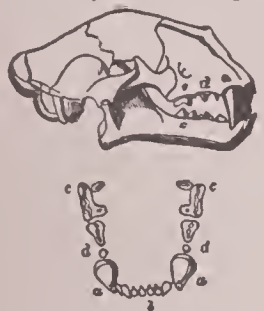
FEEHAN, Patrick Augustine, American Roman Catholic prelate, born in Tipperary, Ireland, in 1829. He came to the U. States in 1852, when he was ordained. He was installed as first Arch-

bishop of Chicago in 1880. During his administration he founded several new parishes, a college of the Christian Brothers and other institutions. He died in 1902.

FEEJEE. See Fiji.

FEELING, is properly a synonym for sensation, or that state of consciousness which results from the application of a stimulus to the extremity of some sensory nerve. It is the most universal of the senses, existing wherever there are nerves; and they are distributed over all parts of the body, though most numerous on such parts as the fingertips and the lines where skin and mucous membrane pass into each other. This universal distribution of feeling is necessary, otherwise parts of the body might be destroyed without our knowledge. The structures which thus apprehend the impressions of contact are papillæ or conical elevations of the skin in which the nerves end, and which are richly supplied with blood-vessels. The term feeling is also used for a general sense of comfort or discomfort which cannot be localized, and it is thus that the disturbances of internal organs often manifest themselves. In a figurative sense the term is also applied to a mental emotion, or even to a moral conception; thus we may speak of a friendly feeling, a feeling of freedom.

FE'LIDÆ, animals of the cat kind, a family of Carnivora in which the predaceous instincts reach their highest development. They are among the quad-



Teeth of felidæ.

Skull and teeth of the tiger. *a*, Canines or tearing teeth. *b*, Incisors or cutting teeth. *c*, True molars or grinding teeth. *d*, Carnassial or sectorial teeth.

rupeds what the **Falconidæ** are among the birds. The teeth and claws are the principal instruments of the destructive energy in these animals. The incisor teeth are equal; the third tooth behind the large canine in either jaw is narrow and sharp; and these, the carnissial or sectorial teeth, work against each other like scissors in cutting flesh; the claws are sheathed and retractile. They all approach their prey stealthily, seize it with a spring, and devour it fresh. The species are numerous in Europe, Asia, Africa, and America, but none are found in Australia. The family comprehends the lion, tiger, leopard, lynx, jaguar, panther, chetah, ounce, serval, ocelot, cat, etc.

FELLAH, an Arabian word meaning "peasant," and used for the laboring class in Egypt. The fellahs or fellaheen constitute about three-fourths of the population of Egypt, and are mostly the direct descendants of the old Egyptians, although both their language and religion are now that of their Arabian conquerors. They live in rude huts by the banks of the Nile, and have suffered much from over-taxation and oppressive rule. See Egypt.

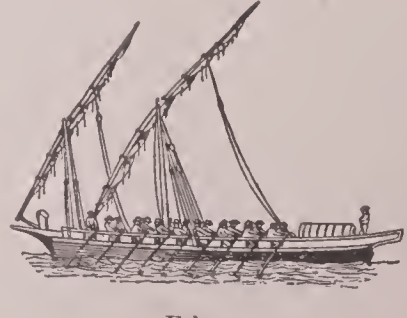
FELO DE SE (Latin, "a felon in regard to himself"), in law, a person that, being of sound mind and of the age of discretion, deliberately causes his own death. Formerly, in England, the goods of such a person were forfeited to the crown, and his body interred in an ignominious manner; that is, unless the coroner's jury gave a verdict of unsound mind; but these penalties have been abolished.

FEL'ONY, in law, includes generally all crimes below treason and of greater gravity than misdemeanors. Formerly it was applied to those crimes which entailed forfeiture of lands or goods as part of the punishment.

FEL'SPAR or **FELDSPAR,** a mineral widely distributed, and usually of a foliated structure, consisting of silica and alumina, with potash, soda, or lime. It is a principal constituent in all igenous and metamorphic rocks, as granite, gneiss, porphyry, greenstone, trachyte, felstone, etc. When in crystals or crystalline masses it is very susceptible of mechanical division at natural joints. Its hardness is a little inferior to that of quartz. There are several varieties, as common felspar or orthoclase, the type of an acid group containing from 7 to 16 per cent of potash; albite and oligoclase, soda felspars, the quantity of soda exceeding that of lime; labradorite and anorthite, lime felspars, the quantity of lime in the latter amounting to 20 per cent.

FELT, a kind of cloth made of wool, or of wool and cotton united by rolling, beating and pressure. The materials to be felted are carded and placed in a machine, where they are kept wet and intimately mixed together by a process of beating. Pressure then unites the whole into a compact mass. The use of felt as a material for hats, tents, cloaks etc., is very ancient. For hat-making the fur of rabbits, beavers, raccoons, and the wool of sheep is generally used. Felt being a good non-conductor of heat is much used for roofing, sheathing boilers, hot-water reservoirs, etc. The felt for such purposes is made from the coarsest woolen refuse from paper-mills.

FELUC'CA, a long narrow vessel, generally undecked, of light draught, and



Felucca.

rigged with large **lateen** sails. They also carry from eight to twelve large oars. They are common in the Mediterranean.

FE'MUR, in vertebrate animals, the first bone of the leg, situated next the trunk of the body, and in man popularly called the thigh-bone.

FENCES, continuous lines of obstacles artificially interposed between one portion of the surface of the land and another for the purpose of separation or exclusion. Live fences are made of hawthorn, holly, box, beech, etc.; dead fences of stone, wood, and in recent times of iron or wire. In agriculture fences are necessary both for restricting the tenant's own animals to their pasture, and for protecting his land from straying animals. The general erection of fences on farms is one of the improvements of modern agriculture.

FENCING, the art of attack and defense with sword or rapier, no shield being used. It was in Italy in the 16th century that the skilful use of the small sword first became common. The art spread to Spain and then to France, where, on account of the prevalence of duelling, it was brought to a high degree of development. The small sword or rapier (which was adopted for duelling) has a point, but no edge, and therefore demands the highest degree of adroitness in its use. In the fencing schools the instrument adopted for exercise is called a foil; it has a guard of metal or leather between the handle and blade, which is made of pliant steel and has a button at the end in place of a point. The parries are made with the weapon itself by opposing the forte of the foil (i.e. the strong part from the handle to the center) to the feeble of the adversary's foil (i.e. to the part from center to point); the upper part of the body to the right is defended by the parry called tierce, the upper part to the left by the carte, and the lower part by the seconde. In all parrying care must be taken that in covering the side attacked the other side is not too carelessly exposed to the enemy. After every parry a return should be made with rapidity and decision. The fencer should rely more upon his sword hand for protection than upon his agility of leg; yet he must be active on his legs so as to advance, retreat, or lunge with effect. The knee should therefore be somewhat bent when the fencer is on guard, that he may be light and elastic in his movements. An attack may be made by the mere extension of the arm, or accompanied by a lunge, that is, by advancing the body, stepping forward with the right foot without moving the left. An engagement means the crossing of the blades; a disengagement, slipping your foil under the opponent's and then pressing in the opposite direction; riposte, the attack without pause by a fencer who has parried. Fencing with the broadsword differs essentially from that with the foil, as the former has an edge as well as a point, and is therefore meant to cut as well as thrust. According to the instructions of drill-masters there are seven cuts, with corresponding guards, and three thrusts. Cut one is a diagonal, downward cut at the left cheek of the adversary; cut three is delivered with an upward slope at the left leg, and cut five horizontally at the right side; cuts two, four, and six attack the right cheek, right side, and right leg respectively; and cut seven is directed vertically at

the head. Guards one and two defend the upper portion of the body, the sword sloping upwards in an opposite direction to the opponent's; guards three and four protect the legs, the sword sloping downward; guards five and six defend the sides, when the sword is held vertically, point downward; and guard seven protects the head, the blade meeting the enemy's almost at a right angle. Since the introduction of the bayonet, bayonet exercise has become an important department of fencing in the army. In handling the bayonet defensively the right foot is thrown back and receives most of the weight of the body, the knees are bent, the bayonet brought to a horizontal position level with the waist. This is the "guard," and according to the parry to be made the weapon is carried either to the "high" position, pointing upward from the breast, or to the "low" position, pointing downward from the breast. In taking the offensive the right leg is straightened, and the left bent forward, without moving the feet from their place. The butt of the rifle is pressed firmly to the shoulder and points straight forward. In "shortening arms" the butt is carried back to the full extent of the right arm, while the barrel (turned downward) rests upon the left arm. The body rests upon the right leg, which is slightly bent, while the left is somewhat advanced.

FENELON (fān-lōn), François de Salignac de la Mothe, born in 1651 at the Château Fénelon, in Périgord, of a family illustrious in church and state. He took orders at the age of twenty-four, and distinguished himself in the work of converting Protestants. In 1681 his uncle conferred on him the priory of Carennac. Soon after he wrote his first work, Traité de l'Education des Filles, which was the basis of his future reputation. In 1689 Louis XIV. intrusted to him the education of his grandsons, the Dukes of Burgundy, Anjou, and Berri. In 1694 he was created Archbishop of Cambray. A theological dispute with Bossuet, the virtual head of the French Church, terminated in his condemnation by Pope Innocent XII., and his banishment to his diocese by Louis XIV. Fénelon submitted without the least hesitation, and thenceforward lived contentedly in his diocese, sustaining the venerable character of a Christian philosopher, and scrupulously performing his sacred duties. He died in 1715. He left numerous works in philosophy, theology, and belles-lettres. The most celebrated is Les Adventures de Télémaque, in which he endeavored to exhibit a model for the education of a prince. It was commonly taken for a satire on the reign of Louis XIV., though nothing probably, was further from the mind of Fénelon.

FE'NIANS, a name usually derived from Fionn or Finn, the name given to a semi-mythical class of Irish warriors famous for their prowess. The name has been assumed in recent years by those Irish who formed a brotherhood in their own country and in America, with the intention of delivering Ireland from the sovereignty of England, and establishing an Irish republic. About the end of 1861 the Fenian Brotherhood was regularly organized in America; The close of the civil war, when large numbers of Irish soldiers were released from service, was thought to be a convenient time for taking decisive steps. Two risings were planned in Ireland, but they were both frustrated by the energetic measures of the British government. An invasion of Canada, failed as miserably as the attempt in Ireland, and convinced the Irish that they could not expect the aid from the U. States on which they had hitherto counted. At last, on 5th March, 1867, the long-prepared insurrection broke out almost simultaneously in the districts of Dublin, Drogheda, and Kerry. The number of insurgents in the field, however, did not exceed 3000, and though they burned some police stations, they nowhere faced the troops sent after them. About the same time some forty or fifty Irish-Americans landed in a steamer near Waterford, but soon after fell into the hands of the police. In 1870 and 1871 two raids were again made on Canada, but both were ridiculous failures, the first being repulsed by the Canadian Volunteers, and the second suppressed by the United States government. At present the brotherhood seems to have suspended active operations.

FENNEC, a small animal allied to the dog and fox, and sometimes called the Sahara fox, being a native of that region.

Fennec.

It lives on birds, jerboas, lizards, dates, etc., burrows with great facility, and is easily tamed. It is fox-like in appearance, and is remarkable for the great size of its ears.

FENNEL, a fragrant plant, cultivated in gardens. It bears umbels of small yellow flowers, and has finely divided leaves. The fruit, or in common language the seeds, are carminative, and frequently employed in medicine.

FER'DINAND, German emperors:—1. Ferdinand I., brother of Charles V., born at Alcala, in Spain, 10th March, 1503. On the abdication of Charles he succeeded to the imperial title. He died 25th July, 1564.—2. Ferdinand II. was born in 1578, and succeeded his uncle Matthias as Emperor of Germany in 1619. He was of a dark and reserved character, and had been brought up by his mother and the Jesuits in fierce hate of Protestantism. The result was a quarrel with his Bohemian subjects, who openly revolted and offered the Bohemian crown to the Elector Palatine, a step which led to the outbreak of the Thirty Years' war (1619). He died Feb. 15, 1637.—3. Ferdinand III., son of the preceding, was born in 1608, and succeeded his father in 1637. He had served in the Thirty Years' war and had seen the miseries which it occasioned and was reluctant to continue it. There were eleven years more of it, however, before the Peace of Westphalia was concluded in 1648. Ferdinand died in 1657.

FERDINAND I. of Bourbon, King of the Two Sicilies (previously Ferdinand IV. of Naples), born January 12, 1751, was the third son of Charles III., King of Spain, whom he succeeded in 1759, on the throne of Naples, on the accession of the latter to that of Spain. In 1768 he married Maria Caroline Louisa, daughter of the Empress Maria Theresa, who soon acquired a decided influence over him. He died in January, 1825, and was succeeded by his son, Francis I.

FERDINAND II., King of the Two Sicilies, born in 1810, succeeded his father Francis I. on the 8th of November, 1830. The revolution of France in this year had unsettled the minds of men throughout the continent, and Ferdinand was forced to make concessions to his subjects, but soon recalled them, determining thenceforward to make his will the only law. He died in 1859 and was succeeded by his son, Francis II., who lost his crown when Italy was united in 1860 under Victor Emmanuel.

FERDINAND V., King of Aragon, who received from the pope the title of the Catholic, on account of the expulsion of the Moors from Spain, was the son of King John II., and was born March 10, 1453. On the 18th of October, 1469, he married Isabella of Castile, and thus brought about that close connection between Aragon and Castile which became the basis of a united Spanish monarchy and raised Spain to preeminence among European states. After a bloody war of ten years they conquered Granada from the Moors (1491); but the most brilliant event of their reign was the discovery of America, which made them sovereigns of a new world. (See Columbus.) This politic prince laid the foundation of the Spanish ascendency in Europe by the acquisition of Naples (1503), and by the conquest of Navarre (1512); but his policy was deceitful and despotic. He instituted the court of the Inquisition at Seville in 1480, and, to the great injury of Spanish commerce, expelled the Jews (1492) and Moors (1501). He died in 1516.

FERDINAND VII., King of Spain, eldest son of Charles IV., and of Maria Louisa of Parma, born in 1784; ascended the throne in March, 1808, when a popular rising forced his father to abdicate in his favor. A month later he himself abdicated in favor of Napoleon, who conferred the crown on his brother Joseph. Ferdinand returned to Spain in March, 1814. His arbitrary conduct caused an insurrection in 1820, which was at first successful, but Louis XVIII. of France having sent an army to his aid, his authority was once more made absolute in Spain. Having no sons he abolished the act of 1713 by which Philip V. had excluded women from the throne of Spain, and then left his crown to his daughter Isabella to the exclusion of his brother Don Carlos. It was during the reign of this king that the Spanish colonies in America broke away from the mother country.

FER'ETORY, a kind of box made of gold or other metal, or of wood variously adorned, and usually in the shape of a

Feretory.
English medieval silverwork.

ridged chest, with a roof-like top, for containing the relics of saints. It is borne in processions.

FERGHANA', a province of Asiatic Russia in Turkestan, formed in 1876 out of the conquered khanate of Khokand. Area, 36,000 sq. miles. The climate is warm, and the soil in part fertile, but a considerable portion of the country is desert. Pop. about 716,000. Khokand is the capital.

FERGUSON, James, an eminent experimental philosopher, mechanist, and astronomer, was born of poor parents at Keith, in Banffshire, in 1710. While a boy tending sheep he acquired a knowledge of the stars, and constructed a celestial globe. He died in 1776. His principal works are: Astronomy Explained upon Sir Isaac Newton's Principles (1756); Lectures on Mechanics, Hydrostatics, etc. (1760); Select Mechanical Exercises (1773).

FERMANAGH (fer-mä'na), an inland county in Ireland, in the province of Ulster; area, 714 sq. miles, or 457,369 acres. The soil is variable, and not remarkably fertile. The manufactures are unimportant. Politically it is divided into North Fermanagh and South Fermanagh, each sending one member to parliament. Pop. 74,037.

FERMENTATION, the spontaneous conversion of an organic substance into new compounds by the influence of a ferment, these ferments being apparently vegetable organisms of extremely simple type, which by their life, growth, and increase set up fermentation. There are several kinds of fermentation: 1st, the vinous or alcoholic fermentation—the most important from an economic and industrial point of view—in which the sugar contained in liquids is converted into alcohol, carbonic acid, and glycerin; 2d, the acid fermentation, in which spirituous liquors become acid, producing acetic acid; 3d, the putrid fermentation, by which organic substances undergo various alterations according to the nature of the substance, and generally set free poisonous gases. Fermentation is also described as lactic, butyric, etc., according to the nature of the results. The general course of alcoholic fermentation, as seen in brewing and wine making, is as follows:—After a lapse of time, which may vary much according to the temperature and other conditions, the liquid acquires a turbid appearance, there is a slight disengagement of gas, which increases till the liquid begins to effervesce, its temperature rises to a higher point than that of the surrounding air, and its surface becomes covered with a frothy matter known as yeast. The effervescence becomes more and more violent till a climax is reached, when its intensity gradually diminishes, and the disengagement of gas ceases. The yeast then settles down at the bottom of the liquor, which is now entirely deprived of its sugar, and has the characteristic taste and effects of "fermented liquors." The rationale of this process has long been the subject of much discussion, but there can be little doubt that it is due to microscopic organisms (the yeast fungus) which live and multiply in the liquid in which they cause fermentation. And the fermentation may be checked or altogether prevented by anything which prevents the growth of the fungus, for example by the presence of any antiseptic substance such as sulphuric acid, carbolic acid, etc., which acts as a poison on the fungus; or by the liquid being either too hot or too cold (below 50° or above 86° Fahr.). Fermentation differs in kind according to the nature of the substance which produces it, and each kind is the special production of a certain species of organism, no two of which will ever pass into each other. Lactic fermentation, such as occurs in milk, that has been allowed to stand, is caused, according to Pasteur, by the development in the mass of a microscopic fungus, Penicillium glaucum, the sugar of the milk being converted into lactic acid. The acid or acetous fermentation occurs in liquids which have already undergone vinous fermentation. When exposed to the atmosphere such liquids become sour, and vinegar is produced. This change is probably due to the growth of a fungus, Mycoderma aceti (the vinegar plant). Viscous fermentation often accompanies vinous fermentation, making the wine thick and viscous so that it runs out in threads when poured. It occurs at temperatures ranging from 68° to 104° Fahr. Butyric fermentation follows on lactic fermentation when the latter is allowed to proceed after lactate of lime has been formed. It is believed that putrefaction is only a species of fermentation, determined by ferment of the bacteria class. As it is commonly maintained that fermentation may be set up by the necessary germs entering the liquors from the air in which they float, the theory of fermentation has a close connection with that of the germ theory of disease. See Germ Theory.

FERMENT'ED LIQUORS, alcoholic beverages obtained by the fermentation and clarification of saccharine fluids. These have been in use from the earliest times. Among the commonest kinds are wine made from the juice of the grape; ale or beer made from an infusion of malt; cider, from apples; mead, from honey; kumiss made by the Kirghiz from mares' milk; chica from maize by the South American Indians, etc. From all fermented liquors a spirit may be extracted by distillation.

FERNS, a natural order of cryptogamous or flowerless plants, forming the highest group of the aerogens or summit-growers. They are leafy plants, the leaves, or more properly fronds, arising from a rhizome or root-stock, or from a hollow arborescent trunk, and being circinate in vernation, a term descriptive of the manner in which the fronds are rolled up before they are developed in spring, having then the appearance of a bishop's crosier. On the veins of their lower surface, or their margins, the fronds bear small vessels named sporangia, containing spores. These sporecases are arranged in clusters, named sori, which are either naked or covered with a layer of the epidermis, which forms an involucre or indusium. When the spores germinate they produce a

Male-fern.

cellular structure of a leafy description, called the pro-embryo, or prothallus, upon which are developed organs which have received the names of antheridia and archegonia. When produced upon the prothallus these organs do not immediately give origin to a germinating spore, but from their mutual action proceeds a distinct cellular body, destined at a later period to develop into a fruit-bearing frond. Ferns have a wide geographical range, but are most abundant in humid, temperate, and tropical regions. In the tropical forests the tree ferns rival the palms, rising sometimes to a height of 50 or 60 feet. Ferns are very abundant as fossil plants. The earliest known forms occur in Devonian rocks. Various systems of classification for ferns have been proposed. At present the order is usually divided into six or eight sub-orders or tribes distinguished by differences in the structure of the sporangium. The generic characters are founded on the position and direction of the sori and on the venation. A few of the ferns are used medicinally mostly as demulcents and astringents.

FERRA'RA, a city of N. Italy, capital of the province of same name, 26 miles n.n.e. Bologna, in a fertile but unhealthy plain. Pop. 28,814.—The province was formerly a duchy of Italy held by the House of Este as a papal fief from 1471 till 1597, when it fell to the pope. At the unification of Italy under Victor Emmanuel in 1860 it gave its name to a province bounded on the n. by the Po, e. by the Adriatic, s. and w. by Ravenna, Bologna, and Modena; area, 1100 sq. miles; pop. 247,788.

FER'RET, a carnivorous animal closely allied to the polecat, about 14 inches in length, of a pale-yellow color, with red eyes. It is a native of Africa.

Ferrets are used, in catching rabbits, rats, etc., to drive them out of their holes.

Ferret.

FERRIS WHEEL, The, exhibited at the Chicago World's Fair, was a remarkable engineering feature. Its diameter was 270 feet; its circumference 825 feet. Its highest point was 280 feet. The axle was a steel bar, 45 feet long, 32 inches thick. Fastened to each of the twin wheels was a steel hub 16 feet in diameter. The 36 cars on the wheel each comfortably seated 40 persons, wheel and passengers weighing 1200 tons. The two towers at the axis supporting the wheel were 140 feet high. The motive power was a 1000-horse-power-steam-engine under the wheel. By the Ferris wheel the almost indefinite application of the tension spoke to wheels of large dimensions has been vindicated, the expense being far smaller than that of the stiff spoke.

FERROL, a fortified seaport of Northern Spain, in the province and about 12 miles n.e. of the town of Coruña, on a fine island bay, connected with the sea by a channel so narrow as to admit only one ship-of-the-line at a time. The chief naval arsenal of Spain, established on a magnificent scale, is here. The manufactures consist chiefly of swords, cutlery, and military and naval equipments. Pop. 23,811.

FERRY, a particular part of a river, lake, arm of the sea, etc., where a boat or other conveyance plies to carry passengers or goods from one side to the other. The right of establishing a public ferry is usually the prerogative of a government or legislature. The person who has a right of ferry is required to keep a boat or boats suitable for the conveyance of passengers, to charge a reasonable fare, and to provide the requisite landing-places on either bank of the river. No one will be allowed to establish a rival ferry so near the original one as to destroy its custom. Common rowing-boats, sailing-boats, large flat-bottomed barges pulled along a rope stretched from bank to bank for horses and carriages, and steam ferry-boats are among the conveyances.

FERRY, Jules François Camille, French statesman and writer, born at St. Dié in the Vosges, April 5, 1832. He became a barrister at Paris, but devoted himself almost entirely to journalism. In 1869 he was returned as deputy for the sixth arrondissement of Paris and took his seat among the members of the "Left." After the fall of Sedan he became a member of the Government of the National Defense. In 1872 Thiers appointed him minister resident at Athens. In 1879 he became minister of public instruction, and as such introduced an education bill, which among other things forbade unauthorized communities, such as Jesuits, to teach in schools. In 1880, Ferry, having become premier, entered upon a vigorous and somewhat hazardous foreign policy. His seizure of Tunis, in 1881, was so far successful, though it led to his resignation; again premier in 1883 his unfortunate expedition to Tonquin forced him to retire from office. Feb. 24, 1893, he was elected president of the senate, but died March 17 of the same year.

FER'ULA, a genus of umbelliferous plants, whose species often yield a powerful stimulating gum resin, employed in medicine. The species are natives of the shores of the Mediterranean and Persia, and are characterized by tall-growing pithy stems, and deeply-divided leaves, the segments of which are frequently linear.

FESSE (fes), in heraldry, a band or girdle comprising the center third part of the shield, and formed by two horizontal lines drawn across it; it is one of the nine honorable ordinaries. The fesse-point is the exact center of the escutcheon.

FESSENDEN, William Pitt, statesman, born at Boscawen, N. H., 1806. He was elected in 1841 to the congress of the United States, and in 1853, he was elected to the United States senate. In 1864, on the retirement of Mr. Chase from the secretaryship of the treasury, he accepted that portfolio, and discharged the duties of the office during a most critical period of the nation's finances until March, 1865, when he resigned and resumed his seat in the senate, to which he had been re-elected. He died in 1869.

FES'TIVALS, or **FEASTS,** certain days or longer periods consecrated to particular celebrations either in honor of some god, or in commemoration of some important event. Such festivals have prevailed among nearly all nations, both ancient and modern. Among the Jews there are six festivals prescribed in the Scriptures (Lev. xxiii.), and thence called sacred feasts. These are the weekly feasts of the Sabbath; the Passover, or Feast of Unleavened Bread; Pentecost, or the Feast of Weeks; the Feast of Trumpets, or New Moon; the Feast of the Atonement; and the Feast of Tabernacles. Afterward the Feast of Purim (to commemorate the failure of Haman's machinations), and the Dedication of the Temple (after its profanation by Antiochus Epiphanes), were added. Among the ancient Greeks were celebrated the Dionysia; the Eleusiania; the four great national games, the Olympic, the Isthmian, Nemean, and Pythian games. But each community and city had its own local festivals in addition, such as the Panathenæa, held by the tribes of Attica, whose union it was intended to celebrate. Among Roman festivals were the Saturnalia, Cerealia, Lupercali, and others.

The festivals of the Christian church owe their origin partly to those of the Jewish religion, such as Easter, which corresponds to the Passover of the Jews and Whitsuntide, which corresponds to Pentecost; partly also to pagan festivals, which the Christian hierarchy, finding it impossible to abolish them, applied to Christian uses by converting them in festivals of the church. These festivals are divided into movable and immovable; the former those which in different years fall on different days, the latter those which always fall upon the same day. The chief of the movable feasts is Easter, the one on which the position of all the others, except that of Advent Sunday, depends. Septuagesima Sunday falls nine weeks before Easter, Sexagesima Sunday eight weeks, Quinquagesima Sunday seven weeks, the first Sunday in Lent six weeks, and Palm Sunday, one week before Easter. Rogation Sunday falls five weeks, Ascension day forty days, Whitsunday seven weeks, and Trinity Sunday eight weeks after Easter. Ash Wednesday is the Wednesday before the first Sunday in Lent, Maundy Thursday the Thursday, and Good Friday the Friday before Easter, and Corpus Christi is the Thursday after Trinity Sunday. Advent Sunday is the nearest Sunday to the feast of St. Andrew, November 30, whether before or after. The chief immovable feasts are the feast of the Circumcision on the 1st of January, Epiphany on the 6th of January, the Annunciation of the Blessed Virgin on the 25th of March, the Transfiguration of Christ on the 6th of August; the feast of St. Michael (Michaelmas) and All the Angels on the 29th of September, the feast of All-Saints on the 1st of November, the festival of All-Souls on the 2d of November, and Christmas Day or the Feast of the Nativity of our Lord on the 25th of December. The festivals relating to the Virgin Mary in the Roman Catholic Church include: the feast of the Annunciation; the Purification of the Virgin, or Candlemas; the feast of the Visitation of Our Lady; the feast of the Immaculate Conception; the Nativity of the Virgin; the Martyrdom of the Virgin Mary; the Assumption of the Virgin (Aug. 6); and several smaller ones. The worship of the cross introduced two festivals; that of the Invention of the Holy Cross (May 3), and that of the Exaltation of the Cross (September 1). The saints' days that are still held as festivals and have religious services connected with them in the Church of Englnad, are called red-letter days, because they used to be printed with red letters in the church calendar; while the saints' days which were still retained in the calendar at the Reformation, but had no services connected with them, are called black-letter days, because they were printed in black letters.

FESTUS, Sextus Pompeius, a Roman grammarian belonging to the 2d or 3d century of our era, author of an abridgment of a work by Verrius Flaccus called De Verborum Significatione, a kind of dictionary, which is very valuable for the information it contains about the Latin language. The work of Festus was still further abridged in the 8th century by Paulus Diaconus. The one MS. of the original work of Festus is now at Naples.

FE'TISH, or **FETICH,** a word first brought into use by De Brosses, in his work Du Culte des Dieux Fétiches (1760), and derived from the Portuguese feitiço, magic, a word which expressed the Portuguese opinion of the religion of the natives of the west coast of Africa. The Portuguese gave this name to the

idols of the negroes of the Senegal, and afterward the word received a more extensive meaning. A fetish is any object which is regarded with a feeling of awe, as having mysterious powers residing in it, but without any consciousness in

Fetishes of Dahomey, Africa.

the exercise of them. The fetish may be animate, as a cock, a serpent, etc.; or inanimate, as a river, a tooth, a shell. Fetish worship prevails in Guinea and other parts of the west coast of Africa. In addition to the common fetish of the tribe every individual may have one of his own. To this he offers up prayers, and if they are not heard he punishes it, or perhaps throws it away, or breaks it in pieces.

FETUS, FŒTUS, the young of viviparous animals in the womb, and of oviparous animals in the egg, after it is perfectly formed; before which time it is called embryo.

FEUDAL SYSTEM, that system by which land (a fief) is held by a vassal on condition of fidelity, that is, in consideration of services to be rendered to his superior or feudal lord. The nature of the feudal system is to be explained by its origin among the Germanic tribes. In the earliest times the relation of superior and vassal did not exist in connection with the ownership of land. Each freeman had his share of the tribe lands, which were held simply on condition of his fulfilling his public duties of attendance at the councils of the mark or township and performing his share of military service in the wars or musters decreed at such councils. The noble had, of course, more land and more influence than the simple freeman, but there need be no tie of vassalage between them. This seems to have been the primitive social organization of the Anglo-Saxons and other German tribes. The lands held by all freemen, whether noble or ordinary freemen, under this system, are said to be allodial as distinguished from feudal lands, which imply service to a superior lord. By the close of the 10th century, however, this system had undergone considerable modifications. The masses of Teutonic invaders who overran Gaul and England had necessarily to confer exceptional powers on their leaders; and as they were for long very much in the position of military in an enemy's country, these powers were naturally continued. Thus it was that kings, before unknown to the Anglo-Saxons, made their appearance immediately after their descent upon Britain. It was common for a chief or great man to have a retinue or bodyguard composed of valiant youths, who were furnished by the chief with arms and provisions, and who in return devoted themselves to his service. These companions originally received no pay except their arms, horses, and provisions and the portion of the spoils which remained after the chieftain had taken his own share. But when conquered lands came to be apportioned and large districts fell into the hands of kings or dukes and their subordinates, they gave certain portions of the territory to their attendants to enjoy for life. These estates were called beneficia or fiefs, because they were only lent to their possessors, to revert after their death to the grantor, who immediately gave them to another of his servants on the same terms. As the son commonly esteemed it his duty, or was forced by necessity, to devote his arm to the lord in whose service his father had lived, he also received his father's fief; or rather, he was invested with it anew. By the usage of centuries this custom became a right and the fief became hereditary. A fief rendered vacant by the death of the holder was at once taken possession of by his son, on the sole condition of paying homage to the feudal superior. Thus a feudal nobility and a feudal system arose and for a time existed alongside of the old allodial system. But gradually the greater security to be got by putting one's self under the protection of some powerful ruler or leader gave the feudal system the predominance. The free proprietor of landed property, oppressed by powerful neighbors, sought refuge in submitting to some more powerful nobleman, to whom he surrendered his land, receiving it back as a vassal. Even the inferior nobility found it to be to their advantage to have themselves recognized as feudatories of the nearest duke or earl; and as the royal power steadily advanced, the offices of duke, ealdorman, gerefa, etc., were always bestowed by the king. Thus the crown became the source of all authority and possession in the country. The land which had once been "folcland," or the land of the people, became the land of the king, from whom all titles to it were held to be derived. Such at least was the development of feudalism in England, where its centralizing tendencies, especially in the matter of holding lands from the crown, were strongly reinforced by the circumstances of the conquest under William the Norman. Under him and his immediate successors there was a struggle between royalty and the nobility, which ended in the power of the latter sinking before that of the kings. On the other hand, in Germany, France, and elsewhere on the continent, the disintegrating tendencies of feudalism as a system of government had full play. In these countries the weakening of the kingly authority encouraged the great feudal dukes and counts to set up in an almost absolute independence, which in France was afterwards gradually lost as the monarchy grew stronger, but in Germany continued to divide the land down almost to our own times into a number of petty principalities.

Among the chief agencies that overthrew the feudal system were the rise of cities, the change in modes of warfare, and the spread of knowledge and civilization. The spirit of the feudal system, grounded on the prevalence of landed property, was necessarily foreign to cities which owed their origin to industry and personal property, and founded thereon a new sort of power. The growth of this new class, with its wealth and industrial importance, has contributed more than anything else to a social and political development before which the old feudal relations of society have almost totally disappeared. Even yet, however, the laws relating to land still bear the stamp of feudalism in various countries. In England, for instance, all land-owners are theoretically regarded as tenants holding from some superior or lord, though the lord may be quite unknown. See also Middle Ages.

FEUILLANTS (feu-yäṇ), a religious order which arose as a reform of the order of Bernardins, and took origin in the abbey of Feuillants, near Toulouse, established in 1577. There were also convents of nuns who followed the same reform, called Feuillantines. They were suppressed by the revolution of 1789, and their convent in Paris taken possession of by a political club named the Feuillants, of which Mirabeau was a member.

FEUILLET (feu-yā), Octave, a French novelist and dramatist, born at Saint Lô, department of Manché, 1812; came into notice about 1846 with his novels of Le Fruit Défendu, Le Conte de Polichinelle, and a series of comedies and tales. In 1857 the appearance of Le Roman d'un Jeune Homme Pauvre raised Feuillet to the first rank of the novelists of the day. Among his other numerous novels are Monsieur de Camors, Julia de Trécœur, Le Sphinx, Histoire d'une Parisienne, etc. His works have a refined humor, and are free, in great part, from the realistic coarseness of the later French school. He died in 1890.

FEUILLETON (feu-i-toṇ), that part of a French newspaper devoted to light literature or criticism, and generally marked off from the rest of the page by a line. The feuilleton very commonly contains a tale.

FEVER, a diseased condition of the body characterized by an accelerated pulse, with increase of heat, deranged functions, diminished strength, and often with excessive thirst. Fevers usually commence with chills or rigors, known as the cold stage of the disease, although the temperature of the body is really increased. There are also a feeling of lassitude, pains in the back and limbs, loss of appetite, and nausea. This soon develops into the hot stage, in which the pulse quickens and the skin becomes hot and dry. These phenomena are accompanied by thirst, headache, a furred tongue, a constipated state of the bowels and a deficiency in the urinary secretion. The symptoms are generally aggravated at night, and may even be accompanied by slight delirium. After a time the crisis is reached, when the patient either dies from gradual exhaustion or from

hyperpyrexia, or he begins to recover, the febrile symptoms disappearing sometimes quite suddenly, sometimes very slowly. The loss of strength in fever due to the waste of tissue (caused by the abnormal temperature) being greatly in excess of the nutritive supply, together with the general disturbance of functions often brings about fatal results. In many cases fever is only an accompanying symptom of some specific disorder, but in others it is the primary and predominant element, apparently due to some poison operating in the blood. (See Germ Theory of Disease.) These primary or specific fevers may be classified as follows:—

1. Continued Fever, in which there is no intermission of the febrile symptoms till the crisis is reached. Simple fever or febricula, typhus, typhoid (enteric or gastric) fever are examples. Relapsing fever also comes under this head; its chief feature is the recurrence of fever about a week after the subsidence of the symptoms.

2. Intermittent Fever or Ague, in which there is a periodic cessation of the symptoms. The varieties are the quotidian, occurring every day; the tertian, recurring in 48 hours; quartan, recurring in 72 hours or every three days.

3. Remittent Fever, in which there is a short daily diminution of the symptoms. The condition known as hectic fever and yellow fever belong to this class.

4. Eruptive Fevers—(1) Small-pox. (2) Cow-pox. (3) Chicken-pox. (4) Measles. (5) Scarlet-fever. (6) Erysipelas. (7) Plague. (8) Dengue fever. See the separate articles.

FEZ, one of the two capitals of Morocco, 100 miles east of the Atlantic and 85 miles south of the Mediterranean. It is finely situated on the hilly slopes of a valley, on the river Fez, which divide Old Fez from New Fez. There are many mosques, one of them the largest in N. Africa. The sultan's palace is a large but somewhat ruinous structure. Fez was at one time famous as a seat of Arabian learning. It is considered a holy town by the Western Arabs, and was resorted to by them as a place of pilgrimage when the way to Mecca was obstructed. Fez was founded in 793, and was the capital of an independent state from 1202 to 1548, attaining a high state of prosperity. The population is variously estimated from 50,000 to 150,000.

FEZ (from Fez, the above town), a red cap of fine cloth, with a tassel of blue silk or wool at the crown, much worn in Turkey, on the shores of the Levant, in Egypt, and North Africa generally. The core or central part of a turban usually consists of a fez.

FEZZAN', a state of North Africa, in the Sahara, forming a depression surrounded by mountain chains and consisting of a great number of small oases. There are no rivers or brooks, and few natural springs; but water is found in abundance at various depths, generally from 10 to 20 feet. Rain seldom falls; in some districts it does not rain for years together, and but little at a time. The natives are a mixed race of Arabs, Berbers, negroes, etc. Fezzan is governed by a lieutenant-governor under the governor of Tripoli, and dependent therefore on Turkey. Pop., variously estimated, does not probably exceed 50,000.

FIACRE (fē-ā-kr), in France, a small four-wheeled carriage or hackney-coach, so called from the Hotel St. Fiacre, where Sauvage, the inventor of these carriages, established in 1640 an office for the hire of them.

FI'AT (Lat. "let it be done"), in English law, a short order or warrant from a judge for making out and allowing certain processes.

FIBERS, these may be of mineral, animal, or vegetable origin. In the mineral kingdom a fiber which may be so used has been found in asbestos. Among animal fibers the silk obtained from the cocoons of the silk-worm and the wool of the sheep represent two great classes. Of the latter the wool of the sheep is by far the most important on account of its length, its fineness, and the comparative ease with which it can be produced in large quantities for the market. Among other animals whose wool or hair is also used to some extent are the goat, especially of the Angora species, the llama or alpaca, the vicuña, the rabbit, the yak, the chinchilla, etc. But the vegetable kingdom furnishes by far the greatest number and variety of fibers for manufacturing purposes. These fibers are obtained either, as in inexogenous plants, from the sheath of the bark or bast; or, as in endogenous plants, from the cellular tissues and pulp of their roots, stems, and leaves; or, in a few plants, from a hairy covering which grows upon the seeds within the pod. Of the first class are flax, hemp, and China grass. To the second class belong New Zealand flax, Manila hemp, coir of cocoa-nut fiber, and Pita-flax. To the third class belong cotton, vegetable silk. For details see Cotton, Flax, Hemp, Jute, Silk, Wool, etc.

FI'BRIN, a peculiar organic compound substance found in animals and vegetables. Animal fibrin constitutes the solid matter which deposits when blood coagulates, but it is also furnished by the chyle, lymph, saliva, and by pus and other pathological fluids. Fibrin is composed of carbon, nitrogen, hydrogen, and oxygen, and is closely allied to albumen and caseine. It is a very important element of nutrition. In healthy venous blood there is about 2·3 present, but its percentage is slightly more in arterial blood. It is best obtained by switching newly-drawn blood with a glass rod or bundle of twigs, when the fibrin adheres to the rod or twigs in threads, and is purified from coloring matter by prolonged washing and kneading with water, and then by treatment with alcohol and ether to remove fat and other substances.

FIBROUS TISSUE, an animal tissue with a shining silvery luster used to connect or support other parts. It is of two kinds, white, and yellow (elastic). It forms the ligaments, tendons of muscles, etc.

FIB'ULA, in anat. the outer and smaller bone of the leg below the knee, much smaller than the tibia. See Leg.

FICHTE (fih'tē), Johann Gottlieb, German philosopher, born in 1762. After studying at Jena, Leipzig, and Wittenberg he passed several years as a private tutor in Switzerland and in Prussia Proper, and in Königsberg made the acquaintance of the great Kant, who showed some appreciation of his talents. His Versuch einer Kritik aller Offenbarung (Essay towards a Criticism of all Revelation, 1792) attracted general attention, and procured him the professorship of philosophy in Jena in 1793. In 1800 he was one of the most prominent professors of that university during its most brilliant period. Here he published, under the name of Wissenschaftslehre (Theory of Science), a philosophical system, which, though founded on Kant's system, gives the latter a highly idealistic development which was strongly repudiated by the Königsberg philosopher. On account of an article he had written to the Philosophical Journal (on the grounds of our belief in the divine government of the world) he fell under the suspicion of atheistical views. This gave rise to an inquiry, which ended in Fichte losing his chair. He then went to Prussia, where he was appointed in 1805 professor of philosophy at Erlangen. During the war between Prussia and France he went to Königsberg, where he delivered lectures for a short time, returned to Berlin after the Peace of Tilsit, and in 1810, on the establishment of the university in that city, was appointed rector and professor of philosophy. Fichet's philosophy, though there are two distinct periods to be distinguished in it, is a consistent idealism, representing all that the individual perceives as distinct from himself, the ego, as a creation of this I or ego. This ego, however, is not the consciousness of the individual so much as the divine or universal consciousness of which the other is but a part. His philosophy thus came to assume a strongly moral and religious character. He died on Jan. 27, 1814.

FICTION. See Novel and Romance.

FICTION, in law, is an assumption made for the purposes of justice, though the same fact could not be proved, and may be literally untrue. Thus an heir is held to be the same person as the ancestor to the effect of making the heir liable for the debts of the ancestor. The rules by which the existence of legal fictions are limited have been stated as follows: (1) The fiction must have the semblance of truth (2) It shall not be used to work a wrong. (3) It shall only be employed for the end for which it was introduced.

FIDDLE. See Violin.

FIDDLE-FISH. See Angel-fish.

FIDDLE-WOOD, the common name of a genus of trees or shrubs with some twenty species, natives of tropical America. Some of the species are ornamental timber trees; several yield a hard wood valuable for carpenter work.

FIEF (fēf). See Fee, Feudalism.

FIELD, in heraldry, the whole surface of the shield on which the charges are depicted, or of each separate coat when the sheld contains quarterings.

FIELD-ALLOWANCE, an extra payment made to officers of the British army on active service in the field, to compensate partly the enhanced price of all necessaries. These allowances are not made in India.

FIELD-ARTILLERY, light ordnance easy of draught, and hence fitted for rapid movements in the field.

FIELD-CRICKET, campestris, one of the most noisy of all the crickets larger, but rarer than the house-cricket. It frequents hot, sandy districts, in which it burrows to the depth of 6 to 12 inches, and sits at the mouth of the hole watching for prey, which consists of insects.

FIELD, Cyrus West, best known as projector and promoter of first submarine telegraph between Europe and America, was born in 1819. Engaged in business in New York until 1853, when, at age of 33, became interested in submarine cable project. Organized the New York and London Telegraph Company in 1854; induced American government to make ocean surveys; made first attempt to lay cable in 1857. After several failures cables was completed and first message sent by Queen Victoria to President Buchanan on August 16, 1858. This first cables broke almost immediately, and after seven years of effort, Mr. Field, with aid of American and British capital, laid another cable, which was successfully completed July 27, 1866. Mr. Field also originated the elevated railroad project in New York City, and was in railroad business until his death in 1892.

FIELD, David Dudley, American clergyman and historical writer, was born in 1781; father of Cyrus W., David Dudley and Stephen Johnson Field. He died in 1867.

FIELD, David Dudley, a distinguished American lawyer, who devoted his life to the reform of the laws. Was born in 1805. His code of civil procedure was adopted by practically every state in the Union and by Great Britain. Eighteen states adopted his code of criminal procedure and his Outlines of International Law form the basis of the code of nations. He died in 1894.

FIELD DOG, distinct breed of dog with natural instinct for locating game birds and retrieving them after they are killed. Are of keen, alert intelligence, noted for docile disposition, and capable of receiving close training. Field dogs are of various species, the general classes being pointers, setters and retrievers. Pointers locate game birds by sense of smell and indicate their location to the hunter by stopping short and "pointing" with nose directed to the spot. The setter works in a similar manner, but crouches on its haunches when it desires to indicate the presence of the game. The retriever is trained to go into cover or into the water for birds after they have been shot and bring them to its master without mangling them.

Field dogs must be carefully trained from puppyhood. The most important and therefore the first requisite is obedience. The dog after being accustomed to collar and leash, is taught to keep close to its master's heel until it is sent forward. The next step in the training of a dog is to prevent him from flushing the game. Then the animal is taught to range for game and to "down" or return promptly at the proper signal. Retrievers of water birds, of course, receive special training, as their duties differ from the setter or pointer. The setter and pointer are easily taught to retrieve on land. (See Setter, Pointer, Retriever.)

FIELD, Eugene, American poet, journalist and story writer, noted for the touching pathos of his poems on childhood and the eccentricity of his humor, was born in 1850. Began newspaper

Eugene Field.

career on Kansas City Times, later on the Denver Tribune. At age of 33 began department of "Sharps and Flats" in Chicago Daily News, which he kept up until his death, twelve years later. In those twelve years be became recognized as one of America's most versatile humorists. His writings covered a wide gamut, from the quaint and whimsical to the pathetic, grotesque and farcical. Best known poem of childhood, "Little Boy Blue;" writings included "Echoes from a Sabine Farm," "With Trumpet and Drum," and "Love Affairs of a Billionaire." He died in 1895.

FIELDFARE, a song bird of the thrush family, easily tamed and sing well in captivity. Found principally in

Fieldfare.

Norway, but winters in England and along the Mediterranean. General color is gray, throat of reddish yellow streaked with black, back and wings brown, tail nearly black.

FIELD-FORTIFICATION, Field-works, temporary works, such as trenches, rifle-pits, etc., thrown up to strengthen the position of an army operating in the field. See Fortification.

FIELD GAMES, open air athletics consisiting of running, hurdle racing, broad and high jump, pole vaulting, throwing the hammer and putting the shot. Marathon race (25 miles) recently added to interstate and international meets.

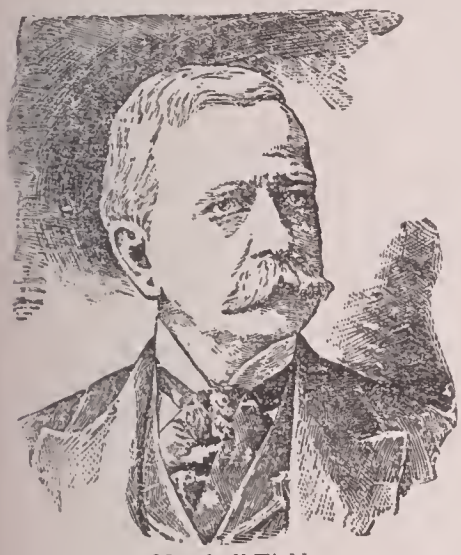
FIELD GLASS, a binocular telescope of great magnifying power used principally by army officers in following military maneuvers. For use in trenches from behind breastworks field glasses are constructed with reflecting prisms which enable one to see without exposing any part of his body. Technically a field glass is a double telescope with chromatic eyeglass.

FIELDING, Henry, one of the greatest of English novelists, was born in Somersetshire, April 22, 1707. He was educated at Eton, whence he removed to Leyden; but the straitened circumstances of his father shortened his academical studies, and turned his attention to the stage. His first dramatic piece was entitled Love in Several Masks, was produced at Drury Lane in 1728, and met with a favorable reception. The Temple Beau, The Author's Farce, The Modern Husband, Don Quixote in England, and many others quickly followed, a number of them being little more than free translations from the French. In 1740 he was called to the bar, and went on circuit, but with so little success that he was compelled to return to literature. In 1742 the first of his great novels, Joseph Andrews, appeared, which he had at first conceived as a burlesque of Richardson's Pamela. It was a great success, and was followed by A Journey From this World to the Next, and the History of Jonathan Wild. In 1749 his masterpiece, The History of Tom Jones, appeared, and was followed two years afterward by Amelia. At length, however, his constitution, exhausted both by hard work and reckless living, gave way, and in June of 1754 he had to seek the milder climate of Lisbon, where he died 8th October of the same year. The chief merits of Fielding as a novelist are wit, humor, correct delineation of character, and knowledge of the human heart. He drew from a varied experience of life, which he reproduced with an artistic realism entitling him to be considered, far more than Richardson, as the creator of the English novel.

FIELD, Kate, American actress, lecturer and journalist; was born in 1840; stage success inconspicuous; best known as editor of "Kate Field's Washington," weekly periodical published at National Capital. She died in 1896.

FIELD, Marshall, American merchant and financier; was born in 1835; clerked in Pittsfield, Mass., store until 1856; then went to Chicago. In 1860 became junior partner in wholesale dry goods establishment. In 1865 headed firm of Field, Palmer & Leiter; in 1881 Marshall Field & Co., built up largest wholesale and retail dry goods business in the world, with branches in England, France and Germany. Invested largely in Chicago real estate before fire of 1871, and became millionaire; largely identified in banking and railroad investments; founded Field Columbian Museum in 1894 with initial gift of $1,000,000, to which his will added $8,000,000. Left fortune variously estimated from $100,000,000 to $150,000,000 to two grandsons, in trust, making them 50 years hence richest heirs in the world. He died in 1906.

FIELD-MARSHAL, the highest military dignity in Britain, Germany, and other countries. In Britain the dignity is conferred by selection and enjoyed by but a very few officers, and chiefly for distinguished services or on the ground of royal descent. It was introduced into Britain by George II. in 1736.



Marshall Field.

FIELD-MOUSE. See Mouse.

FIELD-OFFICERS, in the army, those competent to command whole battalions —majors, lieutenant-colonels, as distinguished from those intrusted with company duties, as captains and lieutenants.

FIELD OF THE CLOTH OF GOLD, a spot in the valley of Andren, between the English castle of Guisnes and the French castle of Ardres, celebrated for the meeting (7th June, 1520) between Henry VIII. of England and Francis I. of France, attended by the flower of nobility of both nations. The diplomatic results were little or nothing, and the event is now memorable only as a grand historical-parade.

FIELD-PIECES, small cannons, from three to twelve-pounders, carried with an army.

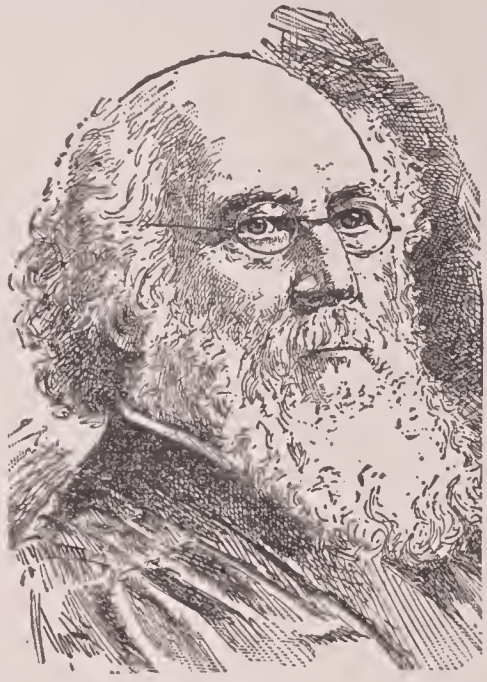
FIELD, Stephen Johnson, was born in 1816; graduate of Williams college 1837; practiced law in New York; went to California as a 49er; on California supreme bench 1857 until 1863. He was appointed to the United States supreme court in 1863. During career as justice of United States supreme court he made many notable dissenting opinions, chief being in legal tender case. As member of electoral commission of 1876-7, which decided Hayes-Tilden controversy, he voted with minority against seating of Hayes. He died in 1899.

FIELD-WORKS. See Fortification.

FIFE, a small instrument of the flute kind, pierced with six finger-holes, and usually having one key. Its ordinary compass is two octaves from d on the fourth line of the treble staff upwards. A combination of fifes and drums is the officially recognized music in the British army and navy.

FIFE, or **FIFESHIRE,** a maritime county, Scotland, forming the peninsula between the Firths of Forth and Tay; extreme length, 43 miles; extreme breadth, 17 miles; area, 316,089 acres. Fife is the third largest coal-producing county in Scotland. Iron, limestone, and freestone abound. There are salmon and other fisheries. The principal towns are Dunfermline, Kirkcaldy, St. Andrews, and Cupar, the county town. Pop. 187,320.

FIFTH, in music, an interval consisting of three tones and a semitone. Except the octave it is the most perfect of concords. Its ratio is 3:2. It is called the fifth as it comes, by diatonic ascent, in the fifth place from the fundamental or tonic. See Music.



Stephen J. Field.

FIG, a deciduous tree belonging to the order Moraceæ (mulberry). It is indigenous to Asia Minor, but has been naturalized in all the countries round the Mediterranean. It grows from 15 to 20 or even 30 feet high. In congenial climates it bears two crops in a season, one in the early summer from the buds of the last year; and other (which is the chief harvest) in the autumn, from those on the spring growth. The fruit is a

Common fig.

hollow receptacle produced in the axils of the leaves on small round peduncles, and containing a great multitude of minute flowers, the ripe carpels of which are embedded in the pulp. The flowers are male and female, the former situated near the orifice at the top, the latter in that part of the concavity next the stalk. Figs, particularly dried figs, form an important article of food in the countries of the Levant. The best come from Turkey.

FIG'ARO, a dramatic character first introduced on the French stage by Beaumarchais in his comedies, the Barber of Seville and the Marriage of Figaro. Figaro is a barber remarkable for his shrewdness and dexterity in intrigue. The plays were adapted for Mozart's Marriage of Figaro and Rossini's Barber of Seville. The name is also well known as that of satirical journals published in Paris and London.

FIGULINE, a name given by mineralogists to potter's clay.

FIG'URAL (or Figurate) **NUMBERS,** numbers formed by the terms of arithmetical series of all sorts, in which the first number is always unity. For example:

I.—	1,	2,	3,	4,	5,	6, etc.
II.—	1,	3,	6,	10,	15,	21, etc.
III.—	1,	4,	9,	16,	25,	36, etc.
IV.—	1,	5,	12,	22,	35,	51, etc.

Those in the second row are called triangular numbers, because their units may be arranged in equilateral triangles; the members of the third row are called square numbers: those of the fourth pentagonal, etc.; and so there are also hexagonal, heptagonal, and, in general, polygonal numbers.

FIGURE-HEAD, the ornamental figure or bust on the projecting part of a

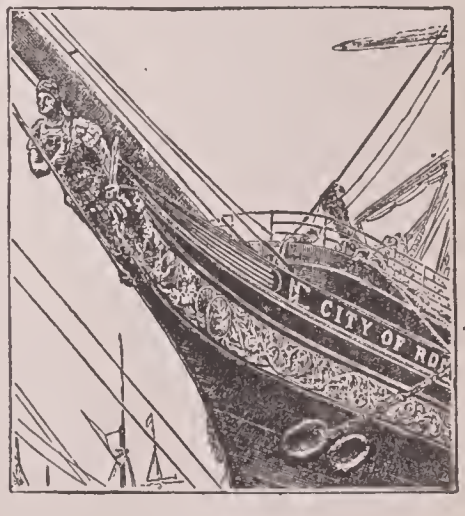


Figure-head.

ship's stem, over the cutwater and immediately under the bowsprit.

FIJI, FEEJEE, or **VITI ISLANDS,** an island group, South Pacific Ocean, east of the New Hebrides, between lat. 15° 30′ and 19° 30′ s.; and lon. 177° e. and 178° w. The entire group, which was discovered by Tasman in 1643, comprises altogether 254 islands and islets, eight of which are inhabited; total area about 8000 sq. miles. Two of the islands only are of large size, namely, Viti Levu, 90 miles long by 60 wide; and Vanua Levu, rather longer but much narrower and more irregular. Next to these come Taviuni and Kandavu. The islands are of volcanic origin, extremely fertile, and covered with a luxuriant foliage, especially on the east side. The Fijians are dark-colored, frizzly-haired, bearded race of Melanesia extraction although intermixed with the Polynesians of Tonga and Samoa. They are cleanly in their habits, and are generally regarded

as superior to the Polynesians in intelligence. Their early character, however, was bad. Cannibalism was reduced to a system, and wives, children, and friends were often sacrificed to the fondness for human flesh. Cannibalism seems now to be abolished. This result has been due to the Christian missions, mostly Wesleyan, which have been very successful, most of the native population having become professed Christians. From 1866 onward the influx of European settlers from New Zealand and the Australian colonies gradually brought the trade of Fiji into importance and repeated applications were made to the British government both by the settlers and the king, Thakombau, to annex the islands. At length in 1874 this was done, and the Fiji Islands were made a crown colony, under a governor, assisted by an executive council and legislative assembly, both, either officials or nominated by the governor. Native chiefs take part in the administration, the old customary law being still largely adhered to. Since the annexation the prosperity of the colony has been remarkable. The population is about 132,000. The Europeans number about 2,000. The capital is Suva, on the south coast of Viti Levu. The island of Rotumah, to the north, was annexed to Fiji in 1881.

FILE, a bar of cast-steel with small sharp-edged elevations on its surface called teeth, the use of which is to cut into or abrade metals, wood, ivory, horn, etc. Files are of various shapes, as flat, half-round, three-sided, square, or round and are generally thickest in the middle, while their teeth are of various degrees of fineness and of different forms. A file whose teeth are in parallel ridges only is called single-cut or float-cut. Such are mostly used for brass and copper. When there are two series of ridges crossing each other the file is double-cut, which is the file best suited for iron and steel. Rasps are files which have isolated sharp teeth separated by comparatively wide spaces, and are used chiefly for soft materials such as wood and horn. Each of these three classes of files is made in six different degrees of fineness, the coarsest being called rough, the next middle, followed by bastard, second-cut, smooth, and superfine or deadsmooth, each a degree finer than that which precedes it. Files are usually made with the hand, file-cutting machines not having been as yet perfectly successful on account of the delicacy of touch required in the work. The blanks, as the steel before it has teeth is called, are laid on the anvil and struck with the chisel, which rests obliquely on the blank, each blow raising a ridge or tooth. The strength of the blow depends on the hardness of the metal, and when one part is harder than another the workman alters his blows accordingly. When one side is covered with single cuts, if the file is to be double cut he adds in the same manner a second series, crossing the others at a certain angle. In making fine files a good file-cutter will cut upwards of two hundred teeth within the space of an inch. The files, except those that are used for soft substances, are then hardened by heating them to a cherry-red color and then dipping them in water. They are then finished by scouring and rubbing over with olive-oil and turpentine.

FILE, a row of soldiers ranged one behind another from front to rear. When a column is arranged two deep, a file is thus two men.

FILE-FISH, a name given to certain fishes from their skins being granulated like a file; one species, a common inhabitant of the Mediterranean, has the power

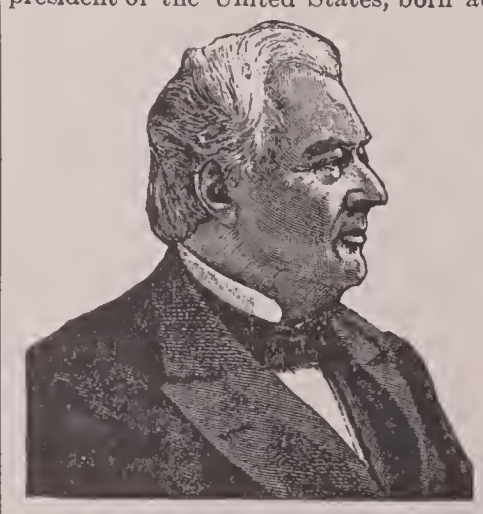
File-fish.

of inflating the sides of the abdomen at pleasure, and grows to the size of two feet. Another species is a native of the Indian and American seas.

FIL'IBUSTERS, a name given to those adventurers, chiefly from the U. States, who endeavored to effect settlements on the Spanish islands and colonies in Central America. The term is of Spanish origin, but is ultimately from the English fly-boat, referring to the small fast sailing vessels used by the buccaneers in the 17th century. Among the most noted of the filibusters was William Walker who made three expeditions to Nicaragua (1855, 1857, 1860).

FILIGREE', a kind of ornamental open work in gold or silver, wrought delicately in the manner of little threads or grains, or of both intermixed. The art was practiced by the Etruscans and the Greeks of the Byzantine empire. In the 17th century it was carried to great perfection in Italy, and silver filigree work is still largely manufactured in the south of Europe. Some of the eastern nations, especially the Chinese and Malays, show great skill in the manufacture of silver filigree.

FILLMORE, Millard, the thirteenth president of the United States, born at



Millard Fillmore.

Sumner Hill, Cayuga co., N. Y., in 1800. In 1822 he removed to Buffalo, N. Y., was admitted to the bar in 1823, and sent to the New York Assembly 1829–32; was in congress 1833–35 and 1837–41, where he was an active and useful member, favoring J. Q. Adams' views upon slavery, and in other public questions acting mainly with the Whigs. In 1844 he was the Whig candidate for governor of New York; in 1847 was chosen comptroller of the state and resigned in 1849; in 1848 was chosen vice-president of the United States on the ticket with Gen. Taylor. On the death of the latter, July 9, 1850, Mr. Fillmore became president. The great events of his administration were the passage of the Compromise acts of 1850 and the Japan expedition of 1852. He died in 1874.

FILTH DISEASES, discoveries in bacteriology and the application of exact methods of research have shown that the importance of filth as a casual factor in the production of disease consists mainly in two facts—first, that it furnishes a good medium for the growth and multiplication of certain forms of pathogenic bacteria when these gain access to it; and, second, that sooner or later such bacteria are very likely to find their way into it.

Of the micro-organisms which produce disease, some, such as the bacillus of typhoid, can grow and multiply in dead organic matter at ordinary temperatures, and a few of them may thus in the course of a few days make all parts of a foul solution dangerous, while others, such as the bacillus of tubercle, require temperatures near that of the living body for development, and hence under ordinary circumstances do not make accumulations of filth infectious. Although small-pox, scarlet fever, diphtheria, measles, and typhus may be conveyed by foul clothing or bedding, yet their spread is usually in no way connected with accumulations of filth, nor are they generated de novo by such accumulations. Typhoid fever is the typical filth disease, in the sense that it is mainly transmitted through human excretia, yet there is no evidence that cesspool or water-supply can become the cause of this disease in any other way than by having the specific bacillus of typhoid added to it. It is possible that a common and under ordinary circumstances harmless form of bacillus may, in the course of time and under special conditions of food and temperature, be so changed in nature and functions as to be capable of producing a transmissible disease, but it is very improbable that such a change gives rise to the ordinary forms of specific disease as seen in practice.

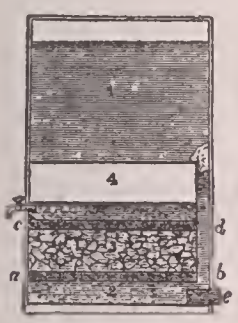
The idea that specific disease of any kind is produced by gases or volatile products of any kind given off by decomposing filth is now generally abandoned, and it is known that the micro-organisms which cause such diseases do not pass into the air from the surface of fluids or from moist surfaces by simple evaporation. They are carried into the air by spray or dust, but not otherwise. Whether yellow fever is a filth disease, in the proper sense of the term, is as yet uncertain, but it is prudent to act on the supposition that its specific germ may be preserved in, and have its powers for evil intensified by, accumulations of hu-

man excreta and by water polluted with such excreta.

The various forms of septic disease, including puerperal fever and those produced by pyogenic organisms, are often due to want of cleanliness of the person, of clothing, of instruments, etc., and such want of cleanliness is apt to occur in connection with or to be produced by the presence of accumulations of filth, and in this sense they may perhaps be called filth diseases. The name "finger-nail fever," which has been applied to puerperal fever, is a very suggestive one.

Filth diseases are to be prevented, by preventing accumulations of filth rather than by trying to disinfect such accumulations, and one of the most important means of doing this for a city is a proper system of sewerage, which involves a good general water-supply and the regulation of the drainage systems in individual houses to insure proper connections and prompt disposal of liquid wastes.

FILTRA'TION, the process of freeing a liquid from solid matter suspended in it by causing it to pass through some pervious substance or substances which catch and retain the solid matter. The materials of which a filter is composed must have pores or interstices sufficiently coarse to allow the passage of the liquid, and yet sufficiently fine to prevent the passage of any solid particles. On a small scale unsized paper is generally used; but on a large scale various kinds of stone, sand, gravel, powdered glass, clay, porous sulphur, preparations of iron, charcoal, cloth, felt, horse-hair, skins, silicated carbon, sponge, wood, wool, cane, capillary threads, etc., are all employed. In domestic filters the simplest forms are those in which the water passes down by its own gravitation through the filtering medium to a reservoir below. Lateral and ascending filtration are not uncommon. One of the most successful forms of ascending filter is divided into four compartments, as seen in the figure. The uppermost part, containing the water to be filtered, communicates with the lowest by a tube having a loose sponge at its mouth to stop some of the impurities. The top of the lowest compartment is composed of a porous slab, through which the water passes into the third part, which is filled with charcoal. The water is lastly forced through the charcoal and another slab into the remaining compartment, which is furnished with a tap to draw off the filtered water. The filters at water-works are large tanks or beds, made of good clay and filled with layers of large stones, pebbles, and coarse gravel, fine gravel, coarse sand and fine sand—the fine sand being at the top. Other materials are sometimes utilized, such as furnace cinders or clinkers, shells or shell-sand, and so forth. The water in the reservoir, collected from springs, surface drainage, and rain, is allowed to deposit its suspended matter in settling-tanks, and then it is run into the filters. By percolation the rest of the mineral matter is removed, and the water then flows into the mains which are to convey it to the locality where it is to be used. Filtration can only remove substances mechanically suspended in the liquid. In order to remove dissolved substances distillation is necessary.



Water filter.

1 2 3 4, The compartments; *a b*, porous top of 2d compartment; *c d*, filtering top of 3d compartment; *e*, movable plug.

FINALE (fi-nä'le), the concluding part of a musical composition, for instance, of a quartette, of a symphony, of any act of an opera, of a ballet, etc. It consists of compositions of various characters.

FINANCE', the system or science of public revenue and expenditure. In the plural the term is applied to the income or revenue of a state, to the funds in the public treasury, and also to private incomes or resources. See such articles as Exchequer, National Debt, Taxation, Bank, etc.

FIN-BACK, or **FINNER,** a name given the species of a genus of whales (Physalus), so called for their possessing a dorsal hump or fin. The name is also sometimes given to the members of the genus Balænoptera or rorquals.

FINCH, one of the Fringillidæ, a large family of small seed-eating birds, inhabiting all parts of the globe, and belonging to the order Insessores, section Conirostres. They are distinguished by having a sharply-pointed, conical, and in most cases a strongly-formed bill, suitable for crushing seeds and other hard objects. The species have been divided among several sub-families, as the haw-finches, the true finches, the buntings, the larks, the bull-finches, etc.

FIN DE SIECLE, a French phrase meaning end of the century, and used adjectively in the sense of peculiar to, or characteristic of, the close of the century or of the epoch; of such character as might be thought fitting to the end of the epoch—overwrought, overestimated, artificial, and sophisticated.

FINDING. In law this term has the same meaning as in popular language. The finder of lost property upon land who takes it into his possession becomes invested with a special property therein, which is superior to the claims of all persons except that of the true owner. He is under no legal obligation to take into his custody any articles he may thus discover, but if he does, certain important rights and obligations immediately attach to his possession. His primary duty is to preserve the property intact, and in as excellent condition as its natural state at the time of finding will permit, in anticipation of the owner's appearing to reassert his title. A finder thus becomes a kind of bailee, and, like other bailees, he may defend his possession and interest by bringing action against any third person who injures the property, or asserts dominion over it, or interferes with his immediate ownership. If the absolute owner ever appears, restoration must be made to him, and the finder will be entitled to no reward if none had been previously offered, and can only claim to be remunerated for the actual and necessary expenses incurred in the proper care of the goods. But if a specific reward had been promised, of which the finder had knowledge, he would be authorized in demanding it and would have a lien upon the property until such charges were satisfied. If at the time of making the discovery the finder knew, or had means of readily ascertaining to whom the property belonged, it would be his duty to seek out the owner and return whatever he had thus acquired; and if he failed to do this his retention of the goods would be a fraudulent appropriation of them which would constitute larceny. But in cases where knowledge of ownership could not be acquired no larceny could be committed. Retaining the chattels would then not be wrongful, but reasonable and obligatory. If the former owner can never be discovered or never asserts any claim to the property, it vests obsolutely in the finder. The place where the finding occurred is immaterial as regards his rights. If an article which was lost in a store was picked up by any stranger, he would have the first claim to it, and if the owner never reappeared might enforce his title even against the storekeeper. This would not be the case, however, if the article was only left by accident, for it would then be regarded as confided to the keeping of the proprietor of the store, who might demand it from any one by whom it was discovered.

FINDLAY, a city and railway center, the capital of Hancock co., Ohio; 90 miles n.w. of Columbus. It is the center of a natural gas-field, and since 1885 has become an important manufacturing center for glass-works, rolling-mills, nail-factories, etc. Pop. 20,162.

FINE, in English law, formerly signified a sum of money paid at the entrance of a tenant into his land and on other occasions, but now generally has the signification of a pecuniary penalty exacted either in punishment of, or in compensation for, an offense, whether committed against an individual, in contravention of the laws of the community, or against the community itself.

FINE ARTS, the arts whose object is the production of pleasure by their immediate impression on the mind, as poetry, music, painting, and sculpture. In modern usage the term is often restricted to the imitative arts which appeal to us through the eye, namely painting, sculpture, engraving, architecture, and is sometimes even restricted to the two first as more essentially imitative and imaginative.

FIN'GAL, a hero of Gaelic romance, celebrated as a great warrior and a generous man in many old ballads belonging alike to Ireland and Scotland; but more especially the hero of an epic poem attributed to Fingal's son Ossian, first published by James Macpherson in 1672. See Ossian.

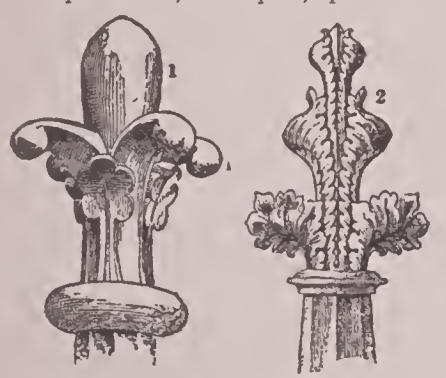
FINGAL'S CAVE, a famous natural cavern in the island of Staffa, one of the western islands of Scotland. It extends 227 feet from its mouth inward, is composed of lofty basaltic columns, beautifully jointed, and of most symmetrical, though somewhat varied forms. The height from the top of the arched roof to the mean level of the sea is 66 feet; the breadth at the entrance 42 feet, at the end of the cave 22 feet.

FINGER-BOARD, the part of a stringed instrument, as the neck of a violin, guitar, etc., to which the fingers (of the left hand) are applied in playing to stop the strings. The finger-board of a keyed instrument (played with both hands) is commonly called a key-board.

FINGERING, in music, (a) the art of dexterously applying the fingers to a musical instrument in playing. (b) The marking of the notes of a piece of music, as for the piano, organ, harmonium, concertina, etc., so as to guide the fingers in playing.

FINGERS. See Hand.

FINIAL, in architecture, an ornamental bunch of foliage which terminates pinnacles, canopies, pediments,



1, Finial, A.D. 1230, Cathedral of Amiens, France. 2, Finial, 15th century.

etc., or any ornament of like kind. By older writers the term is used to denote not only the leafy termination but the whole pyramidal mass.

FI'NING, a substance used to clarify liquors, usually such as are out of condition or are of inferior quality. A solution of isinglass is generally used for beer, and alum, carbonate of soda, salt of tartar, etc., for spirits. Finings always destroy some of the real virtue of the liquor.

FINISTERE (fi-nis-tār; "Land's End"), a department of France, so named from occupying its westernmost extremity; area, 2,595 sq. miles. The soil is generally fertile and well cultivated; fishing is extensively carried on; and the minerals are of considerable importance, including iron, zinc, bismuth, and lead. The manufactures consist chiefly of sailcloth, linen, soap, oil, candles, ropes, leather, paper, and tobacco. Ship-building also is carried on, and the general trade is extensive. Quimper is the capital; other towns are Brest, Châteaulin, and Morlaix. Pop. 707,820.

FINISTERRE, Cape, the most western cape of Spain, on the coast of Galicia.

FIN'LAND, a Russian grand-duchy, containing 134,829 sq. miles, bounded n. by Norway, e. by the governments of Olonetz and Archangel s. by the Gulf of Finland, w. by Sweden and the Gulf of Bothnia. The capital is Helsingfors. The country, in some parts, is hilly, being traversed by the continuations of the Scandinavian Mountains, and, is sandy, marshy, and abounding in lakes, which furnish one of the most characteristic features of the scenery. Tillage and cattle-breeding are carried on to some extent; but the most valuable exports are the products of the forests, timber, pitch, tar, and rosin. The forests occupy 60 per cent of the surface. The climate is severe, but healthy; the mean yearly temperature in the north is 27·5° F., at Helsingfors 38·7°. The principal minerals are iron and copper; granite is extensively quarried. The inhabitants are mostly Finns (see Finns) and Swedes, with a few Lapps, Russians, and Germans. Up to the 12th century the Finns lived under their own chiefs and were pagans. Their conversion to Christianity took place about the middle of that century after their conquest by the Swedes. In 1721 the part of Finland which formed the province of Wiborg was secured to Peter the Great by treaty. The remainder was conquered from the Swedes in 1809. The religion, laws, and liberties of the country have, however, been preserved, and Finland is perhaps the freest part of the Russian empire. The established religion is Lutheran; but there is complete religious freedom for other bodies. The national parliament consists of four estates, the nobles, the clergy, the burgesses, and the peasants, convoked by the grand-duke, the Emperor of Russia. The superior administrative power is in the hands of the senate, which is nominated by the crown, and sits at Helsingfors under the presidency of a governor-general representing the emperor. The governor-general is usually a Russian and is appointed by the emperor. All other officials, as well as the officers of the army, must be Finnish subjects. In 1899 the Czar af Russia made Finland an integral portion of the empire. In 1908 the Czar dissolved the Finnish Diet. Pop 2,250,000.

FINLAND, Gulf of, a great arm of the Baltic, 250 or 260 miles long and from 10 to 70 miles wide, stretching from w. to e. between Finland on the n. and the Russian governments of Esthonia and St. Petersburg on the s. Its waters are only slightly salt. It contains numerous islands, several excellent harbors and strong fortresses.

FINNS, are a race of people inhabiting the northwest of European Russia (governments of Archangel and Olonetz), but especially the grand-duchy of Finland. In a wider sense the term Finns, with its adjective Finnic, is applied to one of the chief branches of the northern or Uralo-Altaic division of the Turanian family of peoples and languages. The Uralo-Finnic family has been divided into four groups or branches: 1, Ugric, to which the Ostiaks, Voguls, and Magyars belong; 2, the Bulgaric or Volgaic, consisting of the Tcheremisses and the Mordvins; 3, the Permic, composed of the Permians, Sirianes, and Votiaks; and 4, the Chudic or Baltic group. To the last belong, besides the Finns proper, the Esths of Esthonia and the Lives or Livonians, the Chudes, in the governments of Novgorod and Olonetz, and the Lapps in Archangel and the northern parts of Finland, Sweden, and Norway. The typical Finns are physically of low stature but of strong build; with round head, forehead low and arched, features flat with prominent cheek-bones, and oblique eyes. Their language belongs to the northern division of the Turanian or Uralo-Altaic family of languages, and is most nearly allied to the languages of the Esths, Lapps, Mordvins, Voguls, and Hungarians. It is agreeable to the ear, rich in vowels and diphthongs, copious, and uncommonly flexible. The language is remarkably rich in declensional forms, there being as many as fifteen different cases, expressing such relations as are expressed in English by near, to, by, on, in, with, without, along, etc. There is no distinction of gender in nouns. The verb resembles the noun in its capability for expressing shades of meaning by corresponding inflections. A great impulse has been given to the cultivation of the language in modern times. It is now recognized as an official language side by side with Swedish, and is becoming more and more the vehicle for imparting instruction. In many of the higher educational institutions for both sexes in Finland the Finnish language is used. Works on science and history as well as poetry have been written in Finnish in recent years; a great Finnish-Swedish dictionary has been published, and there are now a considerable number of newspapers. The center of this literary life is Helsingfors.

FINS, the projecting wing-like organs which enable fishes to balance themselves and assist in regulating their movements in the water. The fin consists of a thin elastic membrane supported by rays or little bony or cartilaginous

Fins—Common perch.

1D, First dorsal. 2D, Second dorsal. P, Pectoral. V, Ventral. A, Anal. C, Caudal.

ossicles. The pectoral or breast fins are never more than two; they are placed immediately in the rear of the gill, opening on the shoulder. In a state of rest these fins are parallel with the body, and have the apex toward the tail. The ventrals, or abdominal fins, are placed under the throat or belly, and point downward and backward. They are smaller, in general, than the pectorals, and have sometimes long appendages. Those of the back, or the dorsal fins, point upward and backward, and vary in number from one to four, to which sometimes are added several finlets or pinnulæ—small appendages which are seen in the mackerel. The anal fins are situated behind the vent, varying in number from one to three, placed vertically, and, like the dorsal, generally deeper on the anterior margin. The caudal, or tail fin, terminates the body, and both propel the fish and serves as

the rudder by which it steers itself. The pectoral and ventral are known as paired fins, and represent the fore and hind limbs of other vertebrates; the dorsal, anal, and caudal are median, vertical, or unpaired fins, and are organs peculiar to fishes.

FINSBURY, a parliamentary borough of England, forming part of London, bounded by the parliamentary boroughs of St. Pancras, Islington, Shoreditch, London City, and Westminster. Pop. 182,109.

FION, FIONN (fē'on), a name given in the Ossianic poetry to a semi-mythical class of warriors of superhuman size, strength, speed, and prowess. Generally they are supposed to have been a sort of Irish militia, and to have had their name from Fion MacCumhal (the Finn MacCoul of Dunbar, and Fingal of Macpherson), their most distinguished leader; but Mr. Skene believes them to have been of the race that inhabited Germany before the Germans, and Scotland and Ireland before the Scots.

FIORD, a geographical term (of Scandinavian origin) applied to long, narrow, and very irregularly-shaped inlets of the sea, such as diversify the coast of Norway. Similar inlets of the sea are presented in the sea-lochs of the west coast of Scotland, as also in the fiords on the southwest coast of the South Island of New Zealand, where the scenery is singularly imposing. Fiords often seem to owe their origin to the action of glaciers in remote epochs of the earth's history.

FIR, a name sometimes used as coextensive with the term pine, and including the whole genus Pinus; sometimes restricted to trees of the genus Abics, which differ from the pines in their leaves growing singly, and the scales of the cones being smooth, round and thin. The term fir, thus limited, is applied to the different varieties of the silver fir and the spruce fir, the common silver fir being the Abies picea of botanists, while the common or Norway spruce is the Abies excelsa. Other species are the great Californian fir, the balm of Gilead fir, the large-bracted fir, the hemlock spruce fir, oriental fir, white spruce fir, Douglas fir, etc. The firs, even in the widest sense of the term, are almost all remarkable for the regularity of their growth, their tapering forms and the great altitude of their stems. Their timber is often highly valuable, being almost solely used in the construction of houses, and for the spars and masts of vessels of all kinds. Some of them are planted mainly as ornamental trees. By some botanists the larch and cedar are included with the firs in the genus Abies. See Spruce, Silver Fir, Hemlock, etc.

FIRE, the simultaneous and vividly perceptible evolution of heat and light during the process of combustion. The uses and dangers of fire, and to some extent the means of controlling it, have been generally understood from a very early period. The symbolic and superstitious uses of fire are numerous, and have been, or are, common to all races. Anciently fire was regarded as one of the four elements of which all things are composed, the other three being air, earth, and water.

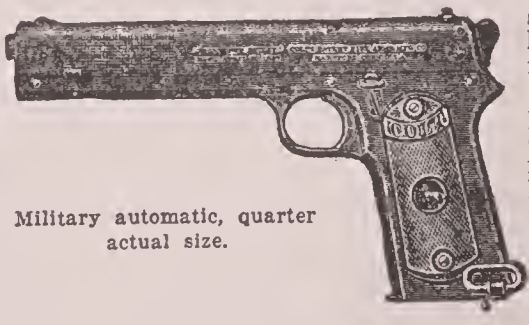
FIRE-ALARM, an apparatus, mechanical, electric, and telegraphic, used for detecting fires, and for giving instantaneous notice of an outbreak. Detectors are often placed in the different apartments of a building, which ring an alarm when the temperature reaches a certain height. In large towns a series of signal-boxes is distributed in different quarters from which an alarm can be immediately telegraphed to the fire department.

FIREARMS, in no other field of the mechanical arts has a greater inventiveness and skill in workmanship been shown than in the evolution of the firearm. From the old horse pistol to the modern self-acting revolver and automatic pistol—from the old muzzle-loading, bell-muzzled fowling piece to

Hammerless.

the modern breech-loading, double-barreled, hammerless shotgun—one may trace the hall marks of mechanical perfection as attained by the artisan of the age.

The old horse pistol was a cylinder of wrought steel, having a breech pin, a pistol stock and nipple for a percussion cap exploding the charge of black gunpowder beneath it. The fowling piece was of a far longer cylinder of steel, with



Military automatic, quarter actual size.

the same general breech lock, cap nipple and fitted with a shoulder stock instead of the pistol butt. Along these same general lines the older flint-lock weapons had been made and down to the present these lines have been preserved to artistic and ultilitarian perfections of the modern firearm.

To-day the American products in defensive and hunting arms take an unquestioned lead in the civilized world. The finish of the watchmaker's art is on them. Utility and beauty of workmanship are balanced in them.

Consider the revolver of modern times. Samuel Colt was its inventor and exploiter before 1840. In that time black powder and the percussion cap were the explosive combination, each of the five or six chambers of the revolver loading from the chamber muzzles and backed by the nipple and the percussion caps. These chambers, rotating within the cylinder, brought the caps under the striking hammer, one after the other.

When a Yankee inventor evolved the metallic cartridge, with its fulminating substance held inside the rim of the copper shell and allowing the shell to be loaded as the cylinder bore itself previously had been loaded, the nipple for the percussion cap was done away with and the breech-loading revolver cylinder was made standard. According to this design the revolver went on to its present perfection, the rim fire cartridge giving way to the surer central fire cartridge and adapting itself to the terrible energy of the smokeless powders.

The term "revolver" comes from the revolving cylinder, though it is often misapplied in speaking of a pistol.

The first hammerless revolver was of American origin and of recent date. The two chief ends of this weapon were the elimination of danger from an explosion caused by striking the hammer, as from a fall, and in taking the projecting thumb piece away it might not become caught in the withdrawal of the weapon from the pocket. A still later device has made it impossible to explode the hammerless revolver unless it shall be clasped by the hand at the moment the trigger is pulled for firing. The mere "breaking" of one of these modern

Featherweight Ejector.

weapons, as necessary for loading, insures through the shell injector the absolute safety that comes of certain emptiness of the cylinder.

The first "automatic" weapon for pocket or holster use was of German origin. It was a heavy, cumbersome mechanism and devoid of all artistic lines. Even at the present time it carries many imperfections of line and balance. But in the smaller sizes for pocket use the doing away with the obtruding cylinder has made it compact for the purpose of concealment. Also it has added three more cartridges to the chamber than is possible for the pocket size, five-shot revolver. The chamber of this automatic pistol is inserted with its eight cartridges into the lower end of the butt. A sliding, forced movement of the barrel mechanism gives the user a full notice that it is loaded. A safety catch makes it safe until the catch is released by thumb pressure. Thereafter from the first shot it becomes the most dangerous weapon ever made.

Using the high explosive cartridge, the recoil from the shot is taken up in cocking the weapon automatically, ejecting the empty shell and forcing the next cartridge into place, ready for the next pull on the trigger. There is no

sense of recoil to the hand holding the gun. A light revolver may "jump" three to six inches from a shot; the automatic pistol holds it quite level, shot after shot until the magazine is empty.

To the untutored or careless user this automatic weapon is one of the most dangerous of arms to himself or to the bystander, in that unless a careful examination be made, the user never knows for a certainty if it be empty. To the weapon-trained man this fact in itself makes always for its safety, in that its terrible muzzle never is pointed in any other than a safe direction. Like the hammerless revolver it cannot be fired save when clasped in the hand and the trigger pulled.

The old Kentucky squirrel rifle was the forerunner of the magazine rifle. No weapon within its range ever exceeded this weapon in accuracy. But modern methods have shortened its long barrel, while modern "rifling" and the gradual constriction toward the muzzle made possible by breech loading has given terrible energy to the conical, jacketed bullet, lead filled into its cone of copper or nickel.

Spencer's carbine of 1860 was the first American adaptation of the breech-loading magazine rifle, carrying a lead missile nearly half an inch in diameter. At close range this soft missile would go through an animal and at the point of egress would leave a wound into which a hand might be thrust. To-day the thin cone of the modern jacketed steel bullet from the modern rifle may pass through the same animal at 3,000 yards and the wound scarcely be found, though a soft-nosed bullet is often used in hunting large game. In the civil war men advanced against the carbine in quadruple lines with success, where to-day against the modern army rifle the same movement would mean the annihilation of a regiment.

Thirty years ago the hunter using the double-barreled muzzle-loading shotgun in a duck blind had no trust in a gun that was not at least 10-gauge with barrels of thirty-two to thirty-six inches. To-day the modern hammerless shotgun of 12-gauge and having twenty-eight-inch barrels is all sufficient, its average of seven pounds, beautifully balanced, contrasting with the over-balanced twelve to fourteen pounds of the old muzzle-loading "duck" gun. Nitro powders, chilled shot and the "choke" boring of the shorter barrels have effected the revolution of the clumsy muzzle-loader.

Of necessity the old muzzle-loading shotgun contained perfect cylinders in its two bores. In the making of such a gun no master of gun making could tell if the gun turned out to the best of his art; one day would throw a shot pattern half equal in efficiency to the pattern of the gun finished the day after. By the laws of choke boring to-day, however, the master of choke boring virtually may make this shot pattern to the order of the sportsman. At forty yards he may cause this pattern to spread 250 pellets within the rim of a Derby hat, or may spread the 250 shot through a thirty-inch circle.

There are several methods of "choking" a gun. The most accepted method, however, is to bore the cylinder in such a way that the barrel's least diameter is from two to three inches from the muzzle. A constriction of five 1,000ths of an inch in the right hand barrel represents a "modified" choke; thirty to forty 1,000ths of an inch in the left hand barrel is the full choke. Ordinarily the two barrels of the gun are not choked in the same degree and the right barrel is less choked in order that in firing the right barrel first by the front trigger, the shooter gets from the full choke of the left barrel a second later the same relative chance at a moving bird.

Once the iron wire twist in a gun barrel stood for the strongest and most ornate possibility for the gun barrel. Steel wire followed iron, until at the present time in the alternating of iron and steel and the manipulation of these metals in the welding, the "chain," "diamond" and other fanciful twists of the Damascus barrels are suggestive of the jeweler's art, while of strength to withstand the wedging charge of chilled shot in front of a dynamite force of the terrible nitro powders.

Twelve years ago the magazine rifle suggested the magazine, or "pump" shotgun. No sportsman handling the finest of Damascus double barrels casts doubt upon the efficiency of the pump gun. At the same time some sportsmen do not take the pump gun afield and on many game preserves it is a discredited arm which would blackball the shooter from club membership. The pump gun carries an average of six shells in its magazine. But its rapidity of action prompts firing at birds in flock until after the murderous possibilities of its killing range are exhausted, countless cripples are made in every killing season to the destruction of fair sport.

This pump gun has its successor in the automatic hammerless shot gun that is in a state of evolution. The magazine just above the trigger is especially cumbersome and heavy, but in use the natural recoil is taken up in the ejection of the shell, and sliding a loaded shell into the barrel, and re-cocking the gun. It works practically upon the same principle as the automatic pistol and its magazine holds five loaded shells.

FIRE-BALL, (1) a ball filled with powder or other combustibles, intended to be thrown among enemies, and to injure by explosion, or to set fire to their works. (2) a popular name applied to a certain class of meteors which exhibit themselves as globular masses of light moving with great velocity, and not unfrequently passing unbroken across the sky until lost in the horizon. They differ from ordinary meteors, probably, more in volume and brilliancy than in any other distinctive characteristic. They are not to be confounded with another class of meteors that explode in their passage, and appear to let fall a dull red body (meteorlite) to the earth.

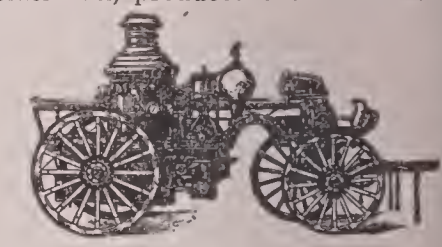
FIRE-BOX, the box (generally made of copper) in which the fire in a locomotive engine is placed. See Boiler.

FIRE-CLAY, a compact kind of clay, consisting chiefly of silica and alumina, capable of sustaining intense heat, and used in making fire-bricks, gas-retorts, crucibles, etc. The most highly esteemed fire-clay is that of Stourbridge, which is used wherever high temperatures have to be resisted. Fire-clay belongs to the coal formation, and always forms a stratum immediately below each seam of coal.

FIRE-DAMP, light carburetted hydrogen gas or marsh-gas. It is sometimes very abundantly evolved in coal-mines, and is productive of the most dreadful results when it explodes, occasioning the death of nearly all then at work in the mine. It appears to be generated by the decomposition of partially carbonized coal, and when it constitutes more than $\frac{1}{18}$th of the volume of the atmosphere of mines the whole becomes highly explosive when fire is brought in contact with it. The safety-lamp affords the chief protection against the fatal effects of this gas.

FIRE-ENGINE, a machine for throwing water for the purpose of extinguishing fire. Machines for the extinguishing of fires have been used from a very early date.

So far as known, the first steam fire-engine was developed by Brathwaite in 1829 or 1830. In 1850 A. B. Latta, in Cincinnati, produced the first machine



Fire-engine.

which was practically useful. Cincinnati was the first city in the U. States to organize a steam fire department, but other large cities and towns rapidly followed the example.

The main parts of the steam fire-engine are the boiler, engine, pumps, and the vehicle on which these are mounted. Boilers are generally of the vertical water-tube type. The engines and pumps are also generally vertical, double-acting, and in duplicate. To facilitate the preparation of fire-engines for service, heaters are maintained in the engine-house to give a constant supply of hot water to the engines. When the alarm strikes the fire is kindled beneath the boiler, and steam is soon available. The rated capacity of steam fire-engines ranges from about 400 to 1300 gallons per minute, and their weights from 5000 to 9500 pounds. The first, and probably the only thorough test of steam fire-engines, was that made in 1876 at the Centennial Exhibition at Philadelphia. A more recent series of tests was made at Boston in 1893. The engines tested were those in regular service by the fire department, some practically new and others fifteen years old. In all cases the engines drew water from a hydrant under pressures of from 30 to 40 pounds. The largest average quantity of water pumped per minute during the whole of one test was 910 gallons, the pumps having been run two hours and twenty-three minutes and throwing

a total of 130,121 gallons of water. The average steam-pressure was 101.3 pounds, and the average water-pressure at the pumps was 112.8 pounds. For shorter periods during this test better results were obtained: thus, for about twelve minutes there was a discharge of 1022 gallons per minute. To enable the engines to be drawn by horses at a high rate of speed, lightness is essential. Fire-engines mounted on fire-boats, like those used by New York, Chicago, Detroit, and other cities, may be designed with less regard for weight and with more consideration for fuel economy; but here, also, quickness and effectiveness of service ranks first; so the chief advantage of such fire-engines is that they may be made practically as capacious and powerful as is desired, and may approach fires closely from the water-front side, where the ordinary steam fire-engine cannot be driven.

Chemical fire-engines and extinguishers range all the way from apparatus mounted on wheels and propelled by horses or men to small tanks carried on a fireman's back, or small hand force-pumps. The aim of all such devices is to smother the fire by means of some gas, such as carbonic-acid gas. The larger and more effective apparatus include a generating tank or tanks, in which water and soda are placed, with an agitator to aid in dissolving the soda, an acid-feeding chamber, and the necessary hose. If the generating apparatus is in duplicate, with proper hose connections, continuous streams may be thrown; otherwise the stream will cease while recharging is in progress. The water serves as a medium to carry the gas, and the gas is the motive force for the water.

FIRE-ESCAPES, a stationary or portable device to escape from burning buildings when ordinary means of egress to the ground are destroyed or cut off by flames. The fire-escape required by most city building laws, consists of balconies attached to the outside of the building, connected by iron ladders with each other, and opening onto each floor at a door or window. Portable fire-escapes may be operated from the interior of the building or from the outside according to their character. Interior fire-escapes of this class vary in character from a simple knotted rope placed in each room, and down which persons seeking escape slide, to more elaborate devices. Portable fire-escapes operated from the outside consist of ladders, telescopic tubes carrying slings, cables which may be thrown up into open windows, etc. One of the most effective of all of these devices is a simple ladder of sufficient length to reach from one story to the next, and provided with large hooks at one end which may be inserted over the window-sill. The first ladder is placed from the ground, the second from the top of the first, and so on until a line of ladders extends from the ground to the top floor, down which the occupants of the building may descend alone or be carried by the firemen.

FIRE-EXTINGUISHER, an apparatus by which fire may be extinguished, by pouring on it water charged with some gas that is incapable of supporting combustion, especially carbonic-acid gas. The Babcock extinguisher consists of a cylindrical vessel which may be carried on the back, filled with a solution of sodium bicarbonate, over which is suspended a vessel containing sulphuric acid, which is made to tilt over and discharge its contents into the solution when brought into use, thus liberating the carbon dioxide. Large cylinders containing chemical salts, have been mounted on wheels, known as "chemical fire-engines," and are used in many of the larger cities.

Hand grenades, or bombs filled with fire-extinguishing solutions of chlorine or ammonium chloride, borax, carbonic-acid gas under preat pressure, mixtures of calcium chloride, magnesium sulphate, sodium carbonate, sodium chloride, and sodium silicate are in common use; but they are of value only in the first stages of a fire.

FIREFLY, a name indefinitely given to any winged insect which possesses much luminosity. Except the lantern-fly, the fireflies are all coleopterous, and are members of two nearly allied families the Elateridæ or skip-jacks, and Lampyridæ, to which the glow-worm belongs

FIRE INSURANCE, just when a scientific system of insurance against loss by fire was first introduced it is impossible to say. In the ordinances of the guilds of the Middle Ages, we find regulations for the payment of indemnity to any member who suffered loss of property by fire.

The earliest recorded proposal for the establishment of a scientific fire-insurance company in England was made in 1635. The first office was opened by N. Barbon, in London, in 1667, the year after the great fire. It is highly probable that the business had already been introduced on the continent.

The first fire-insurance company in the U. States was opened at Philadelphia in 1752, and incorporated in 1768. The development of the fire-insurance business was slow at first, but before the end of the eighteenth century, at least thirty charters had been granted to companies for carrying on the business. The most trying time in the history of fire insurance in the U. States during the last fifty years came in the early seventies. In October, 1871, as a result of the Chicago fire, insurance companies became liable for indemnities amounting to more than $96,500,000. In November of the following year occurred the great Boston fire, which brought a loss of more than $52,600,000 upon the companies. These two great losses, coming in quick succession, subjected all fire-insurance companies to great strain. More than a hundred of them were forced to suspend operations, while many others found their surplus wiped out and their capital seriously impaired.

The year 1906 tested the financial strength of the fire insurance companies to the limit. The earthquake in San Francisco on April 18 was followed by a fire which raged for three days before it was under control. The estimated net losses to the insurance companies was $113,441,595, divided as follows: American companies, $63,771,499; foreign companies, $49,670,096.

On Jan. 1, 1907, there were doing business in the United States 374 joint stock fire insurance companies, and 257 mutual companies. Their combined capital was $84,290,590; their combined assets, $554,331,115; their combined net surplus, $176,942,570. During the year they wrote risks aggregating $30,000,000,000. The figures do not include the operation of some 500 town and county mutual companies, whose transactions are purely local.

Some indication of the increase in the use of fire insurance by property-owners may be gained from a comparison of the total fire loss for different periods with the losses sustained by the insurance companies during the same periods. The figures given in the Spectator year book for 1902 indicate that in the decade 1881–1890, 57.4 per cent of the total fire loss was covered by insurance, while in the decade 1891–1900, 60.9 per cent of the total loss was thus covered. The relation of insurance to the amount of fire loss demands careful consideration. Against the great gain which the system of fire insurance confers upon society must be set a direct loss due to the increase in the amount of property destroyed by fire as a result of the insurance itself. A part of this increased loss is due to the greater carelessness of the owners because of the insurance; a larger part is due to the deliberate destruction of insured property by the owners for the sake of securing the insurance. What proportion of fires is due to incendiarism it is impossible to determine with accuracy. Various estimates, ranging from 20 to 40 per cent, have been made by different investigators. The value of the property deliberately destroyed in order to obtain insurance constitutes one element in the cost of insurance. The insurance companies themselves are indirectly responsible for a part of this loss. It is a matter of common knowledge that agents and brokers show too great laxity in granting insurance on property up to, and sometimes far beyond, its full value. Every instance of over-insurance is a standing invitation to incendiarism.

While a part of the annual loss by fire must be charged against the system of insurance, insurance companies must, on the other hand, be credited with a large share of the responsibility for the discovery and application of methods for preventing such loss. Not only have they always been active, both in the adoption of preventive measures and in compelling or inducing the insured to adopt such measures, but it is also to their initiative that a large part of the progress in state and municipal activity along the same lines have been due.

FIRE ISLAND, or **GREAT SOUTH BEACH,** a low spit of sand, about 50 miles long but broken by inlets, almost 40 miles southeast of New York City. It separates the Great South Bay from the Atlantic Ocean. On its western end is a lighthouse of the first order; also a station from which transatlantic steamers bound for New York are first sighted. The beach is a popular summer resort.

FIRELOCK, a musket or other gun, with a lock furnished with a flint and steel, by means of which fire is produced in order to discharge it; distinguished

from the old matchlock, which was fired with a match.

FIRE OF LONDON, The Great, broke out in a house near London Bridge 2d Sept. 1666, and raged for several days. Two-thirds of London was destroyed—eighty-nine churches and more than 13,000 dwelling-houses. The monument erected by Wren at Fish Street Hill commemorates the great fire, and at one time bore an inscription attributing the fire to Popish faction.

FIRE-PROOFING, various plans have been adopted for rendering houses, or an apartment in a house, fireproof, as by constructing them entirely of brick or stone, and employing iron doors, ties, and lintels, stone staircases and landings. In the case of textile fabrics, as cotton, linen, etc., saturation with various salts, as borax, which leaves their crystals in the substance of the fabrics, is the means adopted for rendering them incombustible. Wood is best protected by silicate of soda, which, on the application of strong heat, fuses into a glass, and this, enveloping not only the outside but also the internal fibers of the wood, shields it from contact with the oxygen of the air. Fireproof safes are generally constructed with double walls and stout iron, having a space between the walls filled with some substance which is a very bad conductor of heat.

FIRE-SHIPS, are generally old vessels filled with combustibles, and fitted with grappling-irons, to hook enemies' ships and set them on fire. This ancient device has been frequently tried in modern warfare, though it can never be of much effect when employed against modern ships.

FIRE-WORSHIP, the worship of fire, the highest type of which worship is seen in the adoration of the sun, not only as the most glorious visible object in the universe, but also as the source of light and heat. In the East the worship of the element of fire was practiced by the ancient Persians or Magians, and is continued by the modern Parsees. The establishment of this species of idolatry among the Persians is ascribed to Zoraoaster, who taught his disciples that in the sun and in the sacred fires of their temples God more especially dwelt, and that therefore divine homage was to be paid to these.

FIRKIN, a British measure of capacity, being the fourth part of a barrel, or equal to 7½ imperial gallons,. or 2,538 cubic inches. It is now legally abolished.

FIR'LOT, a dry measure used in Scotland, but now legally abolished; the fourth part of a boll.

FIRM, a partnership or association of two or more persons for carrying on a business; a commercial house; or the name or title under which a company transact business.

FIR'MAMENT, the vault of heaven. The Hebrew word rakia, which is so rendered in Scripture, conveys chiefly the idea of expansion, although that of solidity is also suggested, inasmuch as the root signification of the word is that which is expanded by beating out. The English firmament is adopted from the Latin firmamentum, which is the equivalent of the Greek stereoma (stereos, firm, solid), by which the writers of the Septuagint rendered rakia.

FIR'MAN, a decree, order, or grant of an Oriental sovereign, as of Turkey, issued for various special purposes, for instance to ensure a traveler protection and assistance.

FIROZABAD', town and municipality in Agra district, in the United Provinces of India, pop. 16,023. Pop. of tahsil or revenue district, 108,521.

FIROZPUR', a thriving commercial town, Punjab, India, capital of a district of the same name. Pop. 50,437. The district forms the southwestern portion of the Jalandhar division. Area, 4,302 sq. miles; pop. 886,676.—Firozpur is also the name of a town in Gurgaon district, Punjab. Pop. 6,878.

FIRTH, Frith, an estuary, a term applied in Scotland to arms of the sea, such as the Firth of Clyde, of Tay, and of Forth, etc. It is the same word as the Norwegian fjord.

FISH. See Ichthyology.

FISH CULTURE, the breeding, rearing, transplanting, and protection of aquatic animals in order to maintain or increase their abundance.

The maintenance of ponds for the rearing of fresh-water fishes for food or ornamental purposes is a very ancient one. In recent years fish culture has become almost synonymous with the harvesting of eggs, their artificial fecundation, and the rearing of the young up to varying stages in hatcheries established for that purpose. The U. States far surpasses all other countries in the extent of this work under Government patronage. The Federal government supports twenty-eight hatcheries at various favorable places, and one steamer, the Fishhawk, a sort of floating hatchery, exclusively used in the actual culture of fishes or in the investigation of problems pertaining thereto. The purpose of the governmental hatcheries is either to stock new waters with desirable species or to maintain by planting the supply in waters already tenanted.

It is now established that waters thus stocked or replenished have not only been able to maintain their supply of fishes, but have greatly increased it. Pacific waters have been successfully stocked with Atlantic species, and almost exhausted streams in various parts of the U. States have been successfully restored. In some species the eggs are not handled, but the spawning fishes are provided with favorable ponds for spawning purposes, where their eggs are protected from enemies, given suitable temperature, etc. This is the case with members of the Centrarchidæ, such as the black bass, which build a nest and guard the eggs during incubation. The young when hatched are either taken from the ponds and fed in suitable troughs until better able to shift for themselves, or are supplied with food in the ponds themselves. In most species, however, the eggs are artificially expelled from the body into suitable receptacles, in which they are fertilized by the addition of milt similarly obtained from the males. After a few moments the eggs are transferred to running water where they are kept and taken care of until the embryos emerge. The exact method employed in fertilization, but especially the subsequent handling of the eggs during incubation, varies considerably with the character of the eggs See Pisciculture.

FISHERIES, a term which includes all the industries concerned in the capture of the inhabitants of fresh and salt water for food and other economic purposes. It is thus applied to the procuring not only of fish proper, but also of other animals and products found in the sea, such as sponges, corals, pearls, shell-fish, turtles, whales, seals, etc. The most important of fresh-water fisheries is that of salmon, which is prosecuted with draw-nets, stake-nets, and by sportsmen with fly-hooks. Trout, eel, pike, and perch are among the other important fresh-water fishes. Sea-fisheries, including the herring, cod, haddock, and other fishes, are prosecuted in a variety of ways. Hand-line and long-line fishing are worked more or less. Of nets the chief varieties are trawls, drift-nets, seines, bag nets, and trammel or set nets. Fisheries have generally been considered so important an object of national wealth that governments have been careful to protect and encourage them in various ways. The right to various fisheries has often been a matter of international disputes, negotiations, and treaties. (See Canada.) Fisheries belonging to particular governments, especially inland fisheries in lakes and rivers, are also frequently protected by laws relating to the mode of capture, etc., which vary with the particular circumstances. The countries whose fishing industries produce the most valuable returns are Great Britain, British North America, and the U. States. The banks of Newfoundland are one of the richest fishing grounds in the world, and are largely frequented by French fishermen. The German Ocean also yields a very rich harvest to the fishermen of all the surrounding coasts, especially in herring, cod, haddock, flat-fish, etc.

FISH, Hamilton, American statesman, born in 1805 in New York City; in 184[illegible] he was elected to congress as a Whig. In 1848 he was elected governor. In 1851 he was elected U. States senator. In March, 1869, Fish was appointed secretary of state, and served throughout both of Grant's administrations, retiring in 1877. In 1871 he was one of the commissioners who negotiated and signed the Treaty of Washington with Great Britain. During the "Alabama Claims" arbitration he was successful in securing the adoption by the tribunal of a provision which relieved the U. States from responsibility for indirect damages arising out of the Fenian raids and Cuban filibustering expeditions. He also brought about the settlement of the long-standing Northwestern boundary dispute with Great Britain, which resulted in the cession to the U. States of the island of San Juan (see San Juan boundary), and the satisfactory settlement of the complications growing out of the Virginius affair. He died in 1895.

FISHES. See Ichthyology.

FISH-GLUE, a coarse species of isinglass.

FISH-HAWK, a name given in America to the osprey or fishing-eagle. See Osprey.

FISH-HOOK, a curved, barbed, and pointed steel wire used for catching fish. Hook-making machines are now common , especially in the U. States, where the wire is run into the machine, and on the other side the hook drops out completed, with the exception that it must be tempered and colored.

FISHING BIRDS, the fishing birds proper include the larger sea-birds, such as the loons, penguins, auks, puffins, tropic-birds, frigate-birds, cormorants and gannets; and certain fresh-water families of higher organization, such as the pelicans, darters, most herons, and some ducks. All are either powerful swimmers and divers, or else are skillful in lying in wait and snatching or piercing any fish that comes sufficiently close to their motionless forms. The instrument (except in the Raptores, which use their talons) is the beak, which is long, straight, sharply pointed, and sharp-edged, so that a firm grip may be had of the slippery bodies of their prey. Many of these birds have a special provision for bringing home a part of their catch to their young, either by swallowing it as far as the crop, whence it may be disgorged, or by storing it in a bag formed by the distensible membrane between the lower mandibles.

FISHING-ROD, a long slender rod, usually made in jointed sections, to which the line is fastened in angling. See Angling.

FISH-JOINT, a splice or joining, as in railways, where two rails end to end are fastened together by flat pieces of iron (fish-plates) placed on each side of the rails, and fastened by screw-nuts and bolts (fish-bolts).

FISH-LOUSE, a name for several crustaceans of the order Ichthyopthira, parasitic on fishes. Some are common on many of the British sea-fishes. Sickly fishes often become the victims of multutides of these creatures, or the sickness is induced by the number which attacks them.

FISH PLATE, a flat plate or bar of iron employed in pairs to connect the ends of adjacent rails in railway track. The two plates are placed on opposite sides of the webs of the rails, and are held by bolts passing through the plates and the webs of the two rails. In order to increase the strength of the joint, the angle bar was devised, having a vertical web like the fish plate and an inclined flange extending over the rail-base. The angle-bar joint is now almost universally employed.

FISK, Clinton Bowen, American soldier and politician; was born in 1828 at Griggsville, N. Y. At the beginning of the civil war he entered the Union Army and in 1865 was brevetted major-general. Subsequently he devoted his life largely to the interests of the colored race; was assistant commissioner in the Freedman's Bureau, and was instrumental in founding Fisk University. He was prohibition candidate for governor of New Jersey in 1886, and for president of the U. States in 1888. He died in 1890

FISK, James, Jr. American stock speculator, born in Bennington, Vt., in 1834. In 1870 he opened a brokerage office in New York City. He picked up a precarious living for some time, until Daniel Drew made him one of his agents in his famous struggle with Cornelius Vanderbilt for the control of the Erie Railway. The Vanderbilt faction was forced out of the directorate, installing Fisk and Jay Gould in their stead. This was the beginning of the association of Jay Gould and James Fisk, which terminated only with the death of Fisk. Gould became president of the Erie Railroad, and Fisk the vice-president and comptroller. From their headquarters a campaign of bribery and corruption was carried on that brought under the power of these men city, state, and federal officials, judges, and legislatures, reaching its climax in the gold conspiracy in 1869 and "Black Friday," when an attempt was made to control President Grant himself. A quarrel with one of his partners, E. S. Stokes in 1872 culminated in his death at the hands of the latter.

FISKE, John, American philosopher and historian, was born at Hartford, Conn., in 1842. He graduated at Harvard College in 1863, and in 1869 began a career of distinguished success as a lecturer at Harvard on Philosophy in its Evolutionary Aspect. In 1884 he was made professor of American History in Washington University, St. Louis. He lectured on American History at University College, London, in 1879, and at the Royal Institution of Great Britain in 1880. He did much to popularize the philosophy of Evolution, and through outlines of Cosmic Philosophy won a national reputation. His contributions in book form to American History constitute practically a connected history of the U. States from the first discoveries to the establishment of federal government. He edited with Gen. James Grant Wilson Appleton's Cyclopedia of American Biography. He died in 1901.

FISKE, Minnie Maddern, American actress, born in New Orleans in 1865. Throughout her childhood she played at times with many well-known actors like Laura Keene, John McCullough, Barry Sullivan and E. L. Davenport. At sixteen she was brought out as a star in Fogg's Ferry and for several years made some success. She has appeared in Ibsen's A Doll's House, A Bit of Old Chelsea, etc. She made a sensation in Tess of the D'Urbervilles and in Becky Sharp.

FISK UNIVERSITY, an institution for the education of colored persons, founded in 1866, at Nashville, Tenn., by the American Missionary Association of New York and the Western Freedman's Aid Commission of Cincinnati. The university at present comprises theological, normal, college, preparatory, music, and industrial departments. The attendance in all departments is over 500.

FISSIROSTRES (-ros'trēz), a tribe of the Insessores or perching birds, distinguished by having a very wide gape extending beneath the eyes. It comprehends the night-jar or goatsuckers, whip-poor-will, swallows, swifts, martins, etc. But in modern classification this division is often disregarded.

FIS'TULA, in surg. a channel open at both ends excavated between an internal part and the skin-surface, showing no tendency to heal, and generally arising from abscesses. It occurs more frequently at some outlet of the body, as the urinary passages and anus.

Fissirostres.

1, Diurna. Head, foot, and bill of a swallow. 2, Nocturna. Head, foot, and bill of a goat-sucker.

FIT, a sudden and violent attack of disorder, in which the body is often convulsed, and sometimes the person is unconscious; as, a fit of apoplexy or epilepsy.

FITCH, William Clyde, an American playwright, born in New York in 1865. His first play, Beau Brummel, was brought out by Richard Mansfield at the Madison Square Theater, New York, in 1890. Among his plays are: Betty's Finish; Frédéric Lemaître; A Modern Match; Pamela's Prodigy; April Weather; Mistress Betty; The Moth and the Flame; Nathan Hale, which has been his greatest success; The Cowboy and the Lady; Sapho; Barbara Frietchie; The Climbers; Captain Jinks of the Horse Marines; Lovers' Lane; The Way of the World; The Last of the Dandies; The Girl and the Judge; and The Stubbornness of Geraldine.

FITCH'BURG, a city (including the villages of West Fitchburg, South Fitchburg, Cleghorn, Crockerville, Rockville, and Traskville) and one of the county-seats of Worcester county, Mass., 25 miles north of Worcester and 50 miles northwest of Boston; on a branch of the Nashua river, and on the Fitchburg division of the Boston and Maine, and the New York, New Haven and Hartford railroads. Pop. 33,000.

FITZGERALD, Edward, English poet, was born near the market town of Woodbridge, in Suffolk, in 1809. In 1853, the first drama of his famous translations appeared: Six Dramas of Calderon. Fitzgerald's intimacy with Professor Cowell, the orientalist, culminated in their study of the Persian poets, and bore important fruit in Fitzgerald's translation of the Salaman and Absal, of Jami, in 1856, and the Rubaiyat three years later. The story of how the now famous quatrains first claimed public attention is well known. Fitzgerald offered some of "the less wicked" of them to Frazer's Magazine; but as they failed to appear, he made a present of them, two years later, to his publisher, Mr. Quaritch, who issued them in a brown-covered pamphlet, at five shillings. In course of time they found their way to a penny box outside the bookseller's door. It was there that Mr. Whiteley Stokes bought the copy which he gave to Dante Gabriel Rosetti, who in turn passed it onto Mr. Swinburne, and thus laid the foun-

dation of the Omar cult in England. It is only just beginning to be recognized that Fitzgerald's Rubaiyat is held in honor, not as Persian, but as English poetry, and that to the great majority the sources are as unimportant as the sources of a play of Shakespeare. He died in 1883.

FIVE FORKS, a locality in Dinwiddie county, Virginia; the scene of an important battle fought 1st April, 1865, one week before the close of the civil war. After heavy fighting the confederates were completely defeated.

FIXED ALKALIES, potash, soda, lithia, and oxides of the rare metals rubidium and cæsium, so named in contradistinction to ammonia, which is termed volatile alkali.

FIXED OILS. See Oils.

FIXED STARS, those stars which appear to remain always at the same distance from each other and in the same relative position. The name comprehends, therefore, all the heavenly bodies, with the exception of the planets, with their moons, and the comets. See Stars.

FIXTURES, in law, are accessories annexed to houses or lands, which by the fact of their being so annexed become a part of the real property and pass to the freeholder, not being removable at will by the tenant or occupier of the property. The general rule of law is that whatever has been affixed to the premises or put into the land by a tenant during his occupancy cannot be removed without the landlord's consent. Large exceptions are made to this rule in favor of the tenant, covering generally fixtures for trade, for agricultural purposes, and for ornament or convenience; but the removal must not injure the land or buildings of the landlord.

FLAG, a piece of cloth on which certain figures or devices are painted, impressed, or wrought, borne on a staff or pole, and usually employed to distinguish one company, party, or nationality from another. In the army a flag is a banner by which one regiment is distinguished from another. Flags borne on the masts of vessels not only designate the country to which they belong, but also are made to denote the quality of the officer by whom a ship is commanded.

FLAG, a popular name for many endogenous plants with sword-shaped leaves, mostly growing in moist situations. It has sword-shaped leaves and yellow flowers, grows in marshy places and by the sides of streams and lakes. The stout creeping root-stock has been recommended for alleviating the toothache, and is used for dyeing black in the Hebrides. The leaves make excellent thatch, and are also employed for making bottoms to chairs.

FLAGELLANTS, (flaj'el-ants), the name of a sect in the 13th century who maintained that flagellation was of equal virtue with baptism and other sacraments. They walked in procession with shoulders bare, and whipped themselves till the blood ran down their bodies, to obtain the mercy of God and appease his wrath against the vices of the age. Rainer, a hermit of Perugia, is said to have been its founder in 1260. He soon found followers in nearly all parts of Italy. Their number soon amounted to 10,000, who went about, led by priests bearing banners and crosses. They went in thousands from country to country, begging alms; and for centuries they formed a sort of intermittent order of fanatics, frequently reappearing here and there in times of extraordinary declension or distress.

FLAGEOLET (flaj'o-let), a small wind-instrument of music, played by means of a mouthpiece. The tone produced is similar to that of the piccolo, but is softer in quality, and the range is two octaves. The double flageolet consists of two instruments united by one mouthpiece, and producing double notes. The name flageolet tones is given to those harmonic tones on the violin, violoncello and other stringed instruments, produced by the finger lightly touching the string on the exact part which generates the harmony, and not by pressing the string down to the finger-board.

FLAG-OFFICER, an officer in the U. States navy entitled by his rank to carry at the masthead a flag instead of a pennant, indicative of his command. At present the flag-officers are admirals, who carry the flag at the main, vice-admirals, who carry it at the fore, and rear-admirals, who carry it at the mizzen. In case a ship has but two masts they are called the fore and main; the flag of a rear-admiral is then hoisted at the main. Previous to the abolition of the grade of commodore officers of this rank were included among the flag-officers.

FLAG OF TRUCE, a white flag shown by one of two forces, indicating a desire to communicate. The necessity of communicating with the enemy in time of war, and the fact that this can usually be best done by means of a flag of truce, has given to the latter a sort of sacred character, which is recognized by all civilized people. A flag of truce, must be sent by the senior officer present, and it can only be received at the will of the senior officer of the other side. In a naval battle the vessel bearing it should not attempt to proceed beyond a point at which her character can be easily ascertained; should she attempt to go farther she may be warned by a shot across her bow, and if she does not then stop she will be fired into. The detention of a flag of truce beyond the lines is a protection to the receiving side against espionage, torpedo attack, etc. Any attempt to obtain information of the enemy's position, condition, or force through a flag of truce may subject the bearer to trial as a spy. In dispatching a flag of truce, except during an engagement, the flagship of the senior officer should keep her colors flying and a white flag at the fore; and if the senior officer of the enemy receives the flag-bearer his ship should do likewise during the progress of the conference, and afterward until the flag-of-truce boat has reached its inner lines. The boat carrying the flag should be met at the proper point by one in charge of an officer of suitable rank from the other senior officer, which should fly a white flag while going and returning.

FLAG-SHIP, a ship in which an admiral, or the commander of a squadron, hoists his flag.

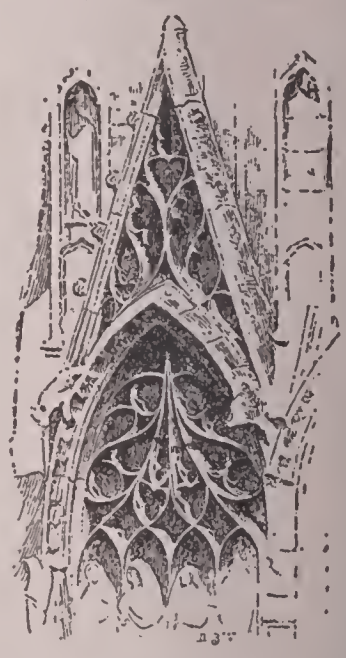
FLAGSTONE, any sandstone, limestone, etc., that is cut or split readily into thin layers, and may be used for pavements, floors, etc.

FLAMBEAU, a sort of torch or light made of some sort of thick wick covered with wax or other inflammable material, and used at night in illuminations, processions, etc.

FLAMBOY'ANT, a term designating a style of Gothic architecture in use in France from the 14th to the 16th century, having prevailed during the whole of the

Flamboyant tracery, St. Ouen, Rouen.

15th century. It was distinguished by the waving and somewhat flamelike tracery of the windows, panels, etc., (hence the name), and is usually regarded as a decadent variety of the decorated Gothic. The moldings in this style are often ill combined, some of the members being disproportionately large or small.



Flamboyant tracery, Rouen cathedral, Normandy.

The pillars are often cylindrical, either plain or with a few of the more prominent moldings of the arches continued down them, without any capital or impost intervening. This is so common that it may be regarded as a characteristic of the style. Moldings also sometimes meet and interpenetrate each other. The arches are usually two-centered, sometimes semi-circular, and, in later examples, elliptical. The foliage enrichments are usually well carved, but the effect is often lost from the minuteness and intricacy of the parts.

Flags of America, Hawaii and Samoa.

1. Flag of the Federated Colonies: *afterwards United States of America.*
2. Flag carried at Bunker Hill, *June 17, 1775*
3. Rattlesnake Flag of the Revolution.
4. Pine-tree Flag: *American Navy 1776-81.*
5. First National Ensign of the United States.
6. Present United States Ensign.
7. U. S. Union Jack: *one Star for each State.*
8. U. S. Narrow Pennant *for Man-of-War.*
9. U. S. President's Flag.
10. U. S. Secretary of the Navy's Flag.
11. Admiral U. S Navy.
12. Vice-Admiral U S. Navy.
13. Rear-Admiral U. S. Navy.
14. U. S. Commodore's Pennant.
    In Nos. 11-14 blue indicates the senior officer, red the next in rank, and white with blue stars, the third.
15. U. S. Naval Despatch.
16. U. S. Naval Convoy.
17. U. S. Revenue.
18. U. S. Lighthouse Service.
19. Quarantine.
20. U. S. Yacht Ensign.
21. Argentine Republic: *Man-of-War Flag. Merchant Flag the same omitting device.*
22. Bolivia: *Merchant Flag.*
23. Brazil: *Ensign*
24. Chile: *National Standard. Merchant Flag lacks device.*
25. Colombia: *Merchant Flag.*
26. Costa Rica: *Man-of-War Flag. Merchant Flag lacks device.*
27. Ecuador: *National and Merchant Flag.*
28. Guatemala: *Man-of-War Flag. Merchant Flag lacks device.*
29. Hawaiian Islands: *before annexation.*
30. Hayti: *Man-of-War Flag. Merchant Flag lacks the white square and device.*
31. Houduras: *Merchant Flag.*
32. Mexico: *Man-of War Flag. Merchant Flag lacks device.*
33. Nicaragua: *Ensign.*
34. Paraguay: *Man-of-War Flag. Merchant Flag has slightly different device.*
35. Peru: *Man-of-War Flag. Merchant Flag lacks device.*
36. Samoa: *Ensign.*
37. San Domingo: *Man-of-War Flag. Merchant Flag lacks device.*
38. San Salvador: *Merchant Flag.*
39. Uruguay: *Ensign.*
40. Venezuela, *Man-of-War Flag. Merchant Flag lacks device.*

FLAGS OF EUROPE, ASIA, AND AFRICA.

1. Austria-Hungary: *Ensign.*
2. Austria-Hungary: *Merchant Flag.*
3. Belgium: *Royal Standard. Ensign lacks device.*
4. Bulgaria: *Merchant Flag.*
5. Burma: *Ensign.*
6. China: *Standard and Ensign.*
7. Corea: *Ensign and Merchant Flag.*
8. Denmark: *Royal Standard. Man-of-War Flag the same, omitting white square and Coat of Arms; Merchant Flag same as Man-of-War Flag, but rectangular*
9. Egypt: *Standard of Khedive. See 40.*
10. France: *Ensign, "Tricolor."*
11. Germany: *Man-of-War Flag.*
12. Germany: *Merchant Flag.*
13. Great Britain: *Royal Standard.*
14. Great Britain: *Union Flag or "Jack." Military Flag and Admiral of the Fleet.*
15. GreatBritain: *Man-of-War Flag.*
16. Great Britain: *Merchant Flag.*
17. Greece. *Man-of-War Flag. Merchant Flag lacks crown in the canton.*
18. Italy: *Man-of-War Flag. Merchant Flag lacks the crown surmounting shield.*
19. Japan: *Imperial Flag.*
20. Japan: *Man-of-War-Flag. Nat'l. Flag without rays.*
21. Liberia: *Ensign, and Merchant Flag.*
22. Montenegro: *Marine Flag.*
23. Morocco: *Ensign, also the Ensign of Zanzibar and several Arab Colonies, and the Merchant Flag of Tunis.*
24. Netherlands: *Royal Flag. Ensign lacks Coat of Arms in the Center.*
25. Norway.
26. Orange Free State (Late): *Ensign*
27. Persia: *Ensign. Merchant Flag lacks device.*
28. Pontifical States: *Ensign.*
29. Portugal: *Ensign.*
30. Rumania: *Merchant Flag.*
31. Russia: *Man-of-War Flag.*
32. Russia: *Merchant Flag.*
33. Sarawak: *Ensign.*
34. Servia: *Merchant Flag.*
35. Siam: *Merchant Flag.*
36. Spain: *Man-of-War Flag.*
37. Spain: *Merchant Flag.*
38. Sweden.
39. Switzerland: *Ensign.*
40. Turkey: *Ensign and Merchant Flag for Turkey, Egypt, and Tripoli. See 9.*

FLAME, a blaze rising from a burning body, or any inflammable gas in a state of visible combustion. Flame is attended with great heat, and sometimes with the evolution of much light; but the temperature may be intense when the light is feeble, as is the case with the flame of burning hydrogen gas. The flame of a a candle may be divided into three zones; an inner zone containing chiefly unburned gas, another zone containing partially-burned gas, and an outer zone where the gas is completely consumed by combination with the oxygen of the air. The luminosity of flame depends upon the presence of extremely small particles of solid matter (usually carbon) or of dense gaseous products of combustion. When the pressure of the gas producing the flame is so great that it is all but flaring, it is found that certain sounds will cause the flame to alter its shape, thus producing the phenomenon of sensitive flames.

FLAMIN'GO, a bird formerly placed in the order of wading birds, but now generally ranked among the Natatores or swimmers, and constituting a family Phœnicopteridæ, allied to the Anatidæ or ducks. Its body is rather smaller than that of the stork, but owing to the great length of the neck and legs it stands from

Red flamingo.

5 to 6 feet high. The beak is naked, lamellate at the edges, and bent as if broken; the feet are palmated and four-toed. The common flamingo occurs abundantly in various parts of Southern Europe, Northern Africa, etc. It is entirely scarlet, except the quill-feathers, which are jet-black. The tongue is fleshy, and one of the extravagances of the Romans during the later period of the empire was to have dishes composed solely of flamingoes' tongues. The flamingoes live and migrate in large flocks, frequenting desert sea-coasts and salt-marshes. They are extremely shy and watchful. While feeding they keep together, drawn up artificially in lines, which at a distance resemble those of an army; and, like many other gregarious birds, they employ some to act as sentinels, for the security of the rest. Their food appears to be mollusca, spawn, crustaceans, etc., which they fish up by means of their long neck, turning their head in such a manner as to take advantage of the crook in their beak. They breed in companies in inundated marshes, raising the nest to a certain, height by heaping up the mud with their feet into a small hillock, which is concave at the top. In this the female lays her eggs, and it was formerly believed that she sat on them with her legs hanging down, like those of a man on horseback. But the nests are not so high as to allow of this, and the birds really sit with their legs doubled up under them.

FLAMSTEED, John, the first astronomer-royal of England, was born 1646, died 1719. He was appointed by Charles II. astronomical observator to the king, and carried on his observations at the Queen's House at Greenwich, until the observatory was built for him in 1676. Here he passed his life; formed the first trustworthy catalogue of fixed stars; and supplied the lunar observations by means of which Newton verified his lunar theory.

FLANDERS, a region of Europe, now included in Holland, Belgium, and France, stretching along the German Ocean. The erection of the territory into a county took place in the 9th century, and was made by Philip the Bold, king of France, in favor of his son-in-law, Baldwin. It afterwards passed to the united houses of Spain and Austria, and ultimately to the latter, but underwent considerable curtailment by the conquests of the French in the west, when part of it became French Flanders, and by the conquests of the Dutch in the north. The remainder still retains its ancient name, and forms the modern provinces of East and West Flanders, in Belgium.—The Belgian province of East Flanders (French, Flandre Orientale) has an area of 1157 square miles. The surface forms an extensive plain, sloping gently eastward. It wholly belongs to the basin of the Schelde. Its soil, partly of a sandy and partly of a clayey nature, is so industriously and skilfully cultivated that it has the appearance of a vast garden. The principal crops are wheat and flax. Linen, laces, and damask are among the important manufactures. Gand or Ghent is the capital. Pop. 1,039,138.—West Flanders (French, Flandre Occidentale) has an area of 1248 square miles. The surface in generally flat; the soil naturally sandy and poor, but well cultivated and fertilized, though not so productive as that of East Flanders. The most important branch of industry is linen. Great quantities of lace also are made. Bruges is the capital. Pop. 816,862.

FLANGE, a projecting edge, rim, or rib on any object, as the rims by which cast-iron pipes are connected together, or the projecting pieces on the tires of the wheels of railway cars to keep them on the rails.

FLANNEL, a woolen fabric of loose texture and various degrees of fineness, much used as a clothing both in hot and cold countries from its properties of promoting insensible perspiration, which is absorbed and carried off by the atmosphere. Welsh flannels have attained a high reputation. In flannel shirtings the wool is frequently mixed with silk, linen, and cotton.

FLAT, a character or sign in music, used to lower or depress, by the degree of a semi-tone, any note in the natural scale. It is marked thus ♭. An accidental flat is one which does not occur in the signature, and which affects only the bar in which it is placed.

FLAT-FISH, a fish which has its body of a flattened form, swims on the side, and has both eyes on one side, as the flounder, turbot, halibut, and sole. The sense is sometimes extended to other fishes which have the body much compressed, as the skate and other members of the ray family.

FLATHEAD INDIANS, tribes established on the Pacific coast, mainly of the now nearly extinct Chinook group of fish-eating Indians They flatten the skull of the infant by pressure. The same custom anciently prevailed among many tribes, but the practice is now nearly extinct. The name Flathead is improperly given to the small civilized tribe of Selish Indians, who do not flatten the heads of their children.

FLAUBERT(flō'bâr') Gustave, French novelist was born in Rome in 1821. He devoted his life to the production of five volumes of rare literary ability—Madame Borary, published in 1857, Salammbô in 1862, L'éducation Sentimentale in 1869, La Tentation de Saint-Antoine in 1874, and the Trois Contes in 1877. He died in 1880.

FLAX, the common name of herbs or small shrubs, with narrow leaves, and yellow, blue, or even white flowers arranged in variously-formed cymes. They occur in warm and temperate regions

Flax.

over the world. The cultivated species which is used for making thread, and cloth called linen, cambric, lawn, lace, etc., consists of the woody bundles of the slender stalks. The fine fibres may be so separated as to be spun into threads as fine as silk. [A most useful oil is expressed from the seeds, and the residue, called linseed-cake, is one of the most fattening kinds of food for cattle. When the plant is ripe it is pulled up by the roots, tied together in little bundles, and usually left upright on the field till it becomes dry, when the seeds are separated, either by beating on a cloth or by passing the stems through an iron comb. The process of removing the seeds is called rippling. The stalks are then retted or rotted in water to free the flaxen fiber from the woody core or boon of the stem. Two operations are necessary to separate the fibers from the woody part of the stem. The flax is first broken by means of a wooden handle and grooved board, or by revolving grooved rollers, and then the boon or woody part is entirely separated from the fiber by a broad flat wooden blade called a scutching blade, or by a machine in which a number of knives attached to the arms of a vertical

wheel strike the flax in the direction of its length, and completely separate it. The flax is next heckled, or combed with a sort of iron comb, beginning with the coarser and ending with the finer, and is now ready for spinning. See Linen.

FLAXMAN, John, one of the most distinguished English sculptors, born at York 1755, died in London 1826. His earliest notions of art were derived from casts in the shop of his father, who sold

John Flaxman.

plaster figures, from many of which young Flaxman made models in clay. In 1770 he was admitted a student of the Royal academy, and for some time earned a living by producing designs for Wedgwood the potter. In 1787 he went to Italy, where he remained seven years, and left many memorials of his genius, besides executing designs in outline to illustrate Homer, Dante, and Æschylus, an extensive series for each.

FLEA, a name for several insects regarded by entomologists as constituting a distinct order Aphaniptera, because the wings are inconspicuous scales. All the

Common flea. (Line shows natural size.)

species of the genus are very similar to the common flea (Pulex irritans). It has two eyes and six feet; the feelers are like threads; the oral appendages are modified into piercing stilets and a suctorial proboscis. The flea is remarkable for its agility, leaping to a surprising distance, and its bite is very troublesome.

FLEA-BEETLE, the name given to different species of beetles which are destructive to plants. The turnip-flea, whose larvæ are sometimes so destructive to the turnip crops, furnishes an example.

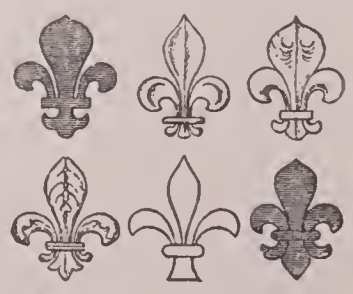
FLEMISH LANGUAGE AND LITERATURE, the Flemish or Vlæmisch language is a form of Low German, differing only slightly in pronunciation and orthography from the Dutch. It is spoken by a considerable number of the inhabitants of Belgium, especially in the provinces of East Flanders, West Flanders, Antwerp, Limburg, and Brabant. A fragment of a prose translation of the Psalms upward of a thousand years old is the oldest extant specimen of the Flemish. The "father of Flemish poetry," Jakob Van Maerlant, wrote several romances dealing with Merlin and the Holy Grail, The Mirror of History, etc., in the 13th century; and a version of Reynard the Fox belongs to the same period. The 14th century was remarkable for the number of wandering poets, authors of knightly romances. The translation of the Bible, which is considered the standard for the construction and orthography of the language, was finished in 1618. The 18th century produced several good writers on philology, but was barren in poetic genius. The French almost annihilated the native literature, and it did not revive till the revolution of 1830, since which time it has been very vigorous. The leaders in this revival were Willems, Blommaert, Van Ryswyck, Conscience, Van Duyse, Snellaert, Snieders, DeLaet, Dedecker, David, and Bormans.

FLEMISH SCHOOL, of Painting. See Painting.

FLESH, a compound substance forming a large part of an animal, consisting mainly of the muscles, with connective tissue, and the blood-vessels and nerves, etc., supplying them. It consists chiefly of fibrin, with albumen, gelatin, hæmatosin, fat, phosphate of sodium, phosphate of potassium, phosphate and carbonate of calcium, sulphate of potassium, and chloride of sodium. The solid part is, besides, permeated by an alkaline fluid, called flesh-juice. It has a red color, and contains dissolved a number both of organic and inorganic substances. The organic matter consists of albumen, casein, creatine and creatinine, inosic and several other acids; the inorganic, of alkaline sulphates, chlorides, and phosphates, with lime, iron, and magnesia.

FLETCHER, John. See Beaumont and Fletcher.

FLEUR-DE-LIS (fleur-dė-lē') Fr., "flower of the lily"), in heraldry a bearing as to the origin of which there is much dispute, some authorities maintaining



Various forms of the fleur-de-lis

that it represents the lily, others that it represents the head of a lance or some such warlike weapon. The fleur-de-lis has long been the distinctive bearing of the kingdom of France.

FLEURY, André Hercule de, cardinal and prime-minister of Louis XV., was born in 1653, died in 1743. In 1698 Louis XIV. gave him the bishopric of Fréjus, and shortly before his death appointed him instructor to Louis XV. After the death of the regent in 1723 he proposed the Duc de Bourbon as first minister, but in 1726 he overturned the government which he had himself set up, and from that date kept the direction of affairs in his own hands. In the same year he was made a cardinal. The internal affairs of France prospered under his administration, but his foreign policy was unfortunate.

FLIGHT. See Flying.

FLINT, the county seat of Genesee co., Mich., on Chi. and Gr. Trunk and Flint and P. Marq. R. Rs.; 61 miles N. W. of Detroit. It is the seat of the Michigan institution for the deaf and dumb. It has a large number of steam saw-mills (manufacturing about 60,000,000 feet of lumber annually). Pop. 15,672.

FLINT, a variety of quartz of a yellowish or bluish-gray or grayish-black color. It is amorphous, and usually occurs in nodules or rounded lumps. Its surface is generally uneven, and covered with a whitish rind or crust, the result of weathering or of the action of water percolating through the rocks. It is very hard, strikes fire with steel, and is an ingredient in glass and in all fine pottery ware. The fracture of flint is perfectly conchoidal; though very hard it breaks easily in every direction, and affords very sharp-edged splintery fragments, formerly made into arrow-heads, etc. (See Flint Implements.) Its true native place is the upper bed of the chalk formation, in which it is formed as a series of concretions, the silica in sponges and in other marine animals which live on the sea floor while the chalk was being deposited being attracted into nodules.

FLINT-GLASS, a species of glass, so called because pulverized flints were originally employed in its manufacture. It is extensively used for domestic purposes. Its dispersive power in regard to light renders it invaluable in the manufacture of the object-glasses of telescopes and microscopes, as by combining a concave lens of flint-glass with one or two convex lenses of crown-glass, which possesses a much less dispersive power, a compound lens is formed in which the prismatic colors arising from simple refraction are destroyed, and the lens rendered achromatic. Quartz and fine sand are now substituted for flint in the manufacture of this glass.

FLINT IMPLEMENTS, implements of flint used by man while unacquainted with the use of metals. For such implements granite, jade, serpentine, jasper, basalt, and other hard stones were also used, but the most numerous were formed of flint. They consist of arrow-heads, axe-heads, lance-heads, knives, wedges, etc. (See Celts.) Flint implements are still used by some savage tribes.

FLINT-LOCK, a musket-lock in which fire is produced by a flint striking on the steel pan, now superseded by locks on the percussion principle.

FLOATING QUARTZ, or **FLOAT-STONE,** a porous variety of quartz of a spongy texture, whitish-gray in color, so light as to float in water. It frequently contains a nucleus of common flint.

FLOCK, the refuse of cotton and wool, or the shearing of woolen goods, etc., used for stuffing mattresses, furniture,

etc. Flockpaper is a kind of wall-paper, having raised figures resembling cloth, made of flock or of cloth cut up very fine, and attached to the paper by size or varnish.

FLODDEN, a village of England, in Northumberland, about 5 miles s. e. of Coldstream. Near it was fought the celebrated battle in which James IV. of Scotland was defeated by the Earl of Surrey (Sept. 9, 1513). The loss of the Scots was from 8,000 to 10,000 men, including the king, the Archbishop of St. Andrews, and a large number of the nobles; that of the English from 6,000 to 7,000. At the beginning of the battle the armies mustered respectively 30,000 and 32,000 men. The English victory was so near a defeat that Surrey was unable to prosecute the war with any vigor.

FLOQUET, (flō′kō′,) Charles Thomas, French statesman and journalist, born at Saint-Jean-de-Luz in Basses-Pyrénées, in 1828. In the organization of the government of national defense in 1870 and during the siege of Paris, Floquet was extraordinarily active, and was later chosen as representative to the national assembly by the department of the Seine. In 1876 he entered the chamber of deputies, voting with the extreme left. He was made prefect of the Seine in 1882, but reëntered the chamber soon after, and from 1885 to 1888, when he became prime minister, was president of that body. In February, 1889, on the defeat of his projected constitutional amendment, he resigned the premiership. The Panama disclosures in 1892–93 implicated Floquet and injured his political standing, although he was elected to the senate in 1894. He died January 18, 1896.

FLORA, the Roman goddess of flowers and spring, whose worship was established at Rome in the earliest times. Her festival, the Floralia, was celebrated from April 28 to May 1 with much licentiousness. In botany, flora signifies the plants of a region collectively, as fauna signifies the animals.

FLORENCE, a celebrated city of Italy, capital of a province of same name, 143 miles northwest from Rome, and 50 miles e. n. e. from Leghorn. The city is surrounded by hills, and is beautifully situated on both banks of the Arno, but the greater part of it lies on the right bank. Six bridges connect the banks of the Arno: the Ponte alle Grazie, constructed 1235, restored 1835; the Ponte Vecchio, said to date from the Roman period, reconstructed 1362, and consisting of three arches, on which are rows of shops, and over which a covered way is carried to connect the Pitti Palace and the Uffizi; the Ponte Santa Trinità, erected soon after 1567, adorned with statues; the Pontealla Carraja, 1218, restored in 1337, and again in 1559. There are, besides, two suspension bridges. On either side of the Arno, is a spacious quay called the Lung' Arno, a favorite promenade. The private dwellings are mostly handsome, and the palaces, of which there are many, are noble and impressive structures. The city contains numerous piazzas or squares, the most important of which is the Piazza della Signoria, surrounded by important buildings, and adorned with a marble fountain, and a bronze statue of Cosmo I. by John of Bologna. In this piazza is situated the Palazzo Vecchio, originally the seat of the government of the republic, and subsequently the residence of Cosmo I. The most remarkable building in Florence is the Duomo, or cathedral of St. Maria del Fiore, erected 1298–1474, but its façade not completed till 1887, surmounted by the magnificent dome of Brunelleschi, and situated in a spacious square nearly in the center of the city. Near the cathedral are the campanile designed by Giotto, and the small church of St. John (San Giovanni) the Baptistery, the three bronze gates of which, with figures in high relief, are celebrated as among the most beautiful works of the kind extant. One of these is by Andrea Pisano, the two others by Ghiberti. The church of S. Croce is the burial-place of many of the most eminent Tuscans, contains much fine sculpture and many interesting tombs, amongst others those of Michael Angelo Buonarotti, Galileo, Machiavelli, and Alfieri. In the Piazza S. Croce stands Dante's monument by Pazzi, inaugurated 1865. The chief art collection is the Galleria degli Uffizi. In this gallery are contained specimens of painting and statuary by the greatest masters in these arts. In statuary, among numerous antiques may be specified the Venus de' Medici, the Apollino, the Knife-grinder, the Dancing Faun, the Wrestlers, and the Group of Niobe and Her Children; and in painting there are works by Michael Angelo, Raphael, Titian, Fra Angelico, Fra Bartolomeo, Andrea del Sarto, Correggio, Guido, and numerous others of the first names in various schools. Other important art collections are preserved in the various churches and palaces, one of the principal being that in Pitti Palace.

Florence—Piazza della Signoria, Palazzo Vecchio, Loggia de Lanzi.

Florence was probably founded by the Romans in the 1st century B.C., and early attained considerable prosperity. During the dark ages it was frequently devastated, but it revived about the beginning of the 11th century, at which time the Florentines became extensive European traders. Their silk and woolen fabrics excelled, and their skill as workers in gold and jewels was unsurpassed. About this time Florence took an active part in the feud which broke out between the Guelphs and Ghibellines, the town generally supporting the former against the imperial party. In 1283 a species of republic was constituted; but about the year 1300 the party struggles again burst forth between the same rival families under the new names of the Whites and the Blacks, in which the Blacks (the Guelphs) were eventually victorious, and the Whites, among whom was the poet Dante, banished. In the course of these troubles a family of merchants named the Medicis rose to great influence in Florentine politics. One of them, Cosmo, born 1389, was the founder of the political greatness of his house. His grandson Lorenzo, surnamed Il Magnifico, as a statesman, scholar, and patron of art and literature, attained the highest celebrity. Under him Florence, which though calling itself a republic, was in reality ruled by him, rose to a great pitch of opulence and power, and notwithstanding the hostility of the pope he exercised a great influence throughout Italy. On the fall of the republic in the 16th century a member of a lateral branch of the Medici, the line of Cosmo having become extinct, was placed by Charles V. as Duke of Florence. The ducal dynasty of Medici continued to rule till the year 1737, when, becoming extinct, they were succeeded by Francis of Lorraine, afterward emperor of Germany. From this period the history of Florence merges into that of Tuscany until its amalgamation with the Kingdom of Italy. From 1865 till 1871 it held the dignity of capital of the kingdom, the seat of government being transferred to it from Turin. Among the illustrious men it has produced are Dante, Petrarch, Boccaccio, Guicciardini, Lorenzo de' Medici, Galileo, Michael

Angelo, Leonardo da Vinci, Benvenuto Cellini, Andrea del Sarto, Amerigo Vespucci, Macchiavelli, and others. Pop. (including suburbs) ,204,950.—The province has an area of about 2262 English square miles. The surfacc is beautifully diversified by mountains, valleys, and plains. The climate is generally mild and healthy, and the soil very fertile. Pop. 937,786.

FLORENCE, William Jermyn, American comedian, born in 1831 at Albany. In 1853 he married Mrs. Malvina Pray Littell, with whom he won great applause in The Irish Boy and Yankee Girl, repeated in London three years later. Among his must successful characters were Bardwell Slotc in the Mighty Dollar; Bob Brierley in The Ticket-of-Leavc Man; and Sir Lucius O' Trigger in The Rivals. This last he played to the Bob Acres of Joseph Jefferson. He died in 1891.

FLORENTINE WORK, a kind of mosaic work, consisting of precious stones and pieces of white and colored marble, which has long been produccd in Florence. It is applied to jewelry, and used for table tops, etc.

FLOR'IDA, one of the United States, forming the southeastern extremity of the country, and having the Gulf of Mexico on the south and west, and the Atlantic on the east. It consists partly of a peninsula stretching s. for about 400 miles, partly of a long, narrow strip of land running along the Gulf of Mcxico to a distance of 350 miles from the Atlantic coast-line. The peninsula is about 90 miles in width, and contains about four-fifths of the total area, which is 59,268 sq. miles. The surface is in general level, rising little above the sea, especially in the southern parts, were it is almost one continued swamp or marsh. The northern portion is more broken and elevated, but the whole coast is flat. The principal river is the St. John's, flowing northward through peninsular Florida to the Atlantic. Its tributary, the Ocklawaha, has its course so flat that for a long distance it spreads out into the forest for half a mile or morc on either side, so that nothing is seen but trees and water. The Appalachicola, Suwanee, etc., flow into the Gulf of Mexico. There are many lakes throughout the peninsula, thc largest being Okeechobee (area 650 sq. miles). Numerous islands are scattered along the south and west coasts, the most remarkable of which is a group, or rather a long chain, called the Florida Keys at the southern extremity of Florida. The most important of these is Key West, containing the city and naval station of same name. The state produces tropical plants and fruits in great perfcction, especially oranges, lemons, limes, shaddock, etc. The planting of orange groves has been carried on extensively in recent times, and oranges are now a speciality of Florida. Tobacco, cotton, sugar, maize, potatoes, rice, oats, etc., are among thc other productions. The forests form an important source of wealth. The minerals are unimportant. The wild animals comprisc panthers, cougars, wolves, bears, foxes, raccoons, opossums, deer, etc. Birds are extremely numerous and various. The coasts, rivers, and lakes swarm with fish; tortoises and turtles also abound. The swamps and other inland waters are infested with alligators. Snakes are numerous, but most of them are harmless. The climate in general is excellent, and the state is much frequented as a winter health resort for invalids, many large and elegant hotels having been built for the accommodation of visitors. Florida, long in a backward condition, has recently madc great advances in prosperity, being now well supplied with mcans of communication, and towns and villages rapidly springingup. Tallahassee

Seal of Florida.

is the capital and seat of government, but the largest town is Key West (pop. 18,000); Jacksonville and Pensacola are thriving ports; St. Augustine is the oldest town in the United States. Proposals have been made to construct a ship-canal through Florida as a short route from the Atlantic to the Gulf of Mexico.

Tallahassee is the capital of the State. Two representatives are sent to the lower house of congress.

Florida was discovered on Easter Sunday, 1512, by Ponce de Leon, who landed near thc site of the present Saint Augustine in search of the Fountain of Perpetual Youth. He failed to find the fountain, and, returning in 1521, found death instead. Ayllon carried off large numbers of Indians from Florida as slaves between 1520 and 1526, and in 1528 Panfilo Narvaez (q. v.) invaded the country with a force of 400 men eager for conquest and booty. Narvaez pushed into the wilderness north of the Gulf, and only survivors of his band, among them Cabeza de Vaca, succeeded in reaching Mexico after infinite hardships. In 1539 Hernando De Soto (q. v.) traversed the country. In 1559 a well-equipped expedition of 1500 men under Don Tristan dc Luna sailed from Vera Cruz, and landed, August 14, on the shores of Santa Maria Bay, probably the Bay of Pensacola. The main body penetrated into the country for a distance of forty days' march, while a smaller detachment explored the region as far as the Coosa River in eastern Alabama. Discouraged by the hardships encountered, the expedition returned to Mexico, after passing more than a year in the country.

Réné Goulaine de Laudonniére, who had accompanied Jean Ribault in his expedition to Port Royal (1562), landed first at what is now St. Augustine, and built Fort Caroline in 1564. The colonists, who were Huguenots, were on the point of abandoning the settlement when reënforced by Ribault. Soon after Menendez surprised and massacred the garrison of Fort Caroline, carrying out to the letter his barbarous order to "gibbet and behead all Protestants in those regions."

On May 28,1586, Sir Francis Drake, entered an inlet and came to the Fort St. Juan de Pinos, from which the garrison fled to St. Augustine; and on the approach of the English they also abandoned this place. Drake pursued his voyage to Virginia, where the queen had commanded him to afford relief to Sir Walter Raleigh's newly-planted colony.

The English colonists of Georgia and Carolina continued to wage war against the Spaniards in Florida. Governor Moore of South Carolina made an unsuccessful attempt on St. Augustine in 1702; and General Oglethorpe of Georgia besieged it in 1740 with the same result. Nearly a hundred years later, in 1837, the United States engineers found balls thrown by Oglethorpe in the moat of the old Spanish fortress. In 1763 Florida was ceded to Great Britain in return for Havana, captured by Albemarle the previous year. Vigorous efforts were made by the British Government to promote settlement by liberal grants of land to settlers. In 1781 Don Bernardo de Galvez, Spanish governor of Louisiana, having previously taken Mobile, besieged and captured Pensacola, thus completing the conquest of West Florida. In 1783 Florida was ceded back to Spain. In February, 1819, a treaty for the cession of Florida to the United States was concluded at Washington, and in 1821 was ratified by the king of Spain. Possession was taken in July by General Jackson, who had been appointed governor of the Floridas by the Government at Washington. Immigration flowed in rapidly from the southern states, the Bahamas, and even the North Atlantic States; but a great drawback to the prosperity of the newly-acquired territory was found in the determined resistance of the warlike nation of Seminole Indians to the encroachments of the whites upon their hunting-grounds. A resolution on the part of the United States Government to remove these Indians led to the long and bloody struggle known as the Seminole War, in which for seven years the Indians successfully defied every effort to subdue them, retreating into the fastnesses of the everglades when closely pressed. Osceola, chieftain of the Seminoles, having been captured by treachery, the war ended in 1842. The remnant of the Indians were removed beyond the Mississippi, and in three years after their expulsion (1845), Florida was admitted into the Union as a state.

On Jan. 10, 1861, Florida, by a convention assembled on the third, seceded from the Union. Fort Marion and the arsenals at St. Augustine and Chattahoochee were seized on the 7th, the forts and dockyards at Pensacola on the 12th, except Fort Pickens, on

Santa Rosa Island, which was held by the United States forces. In April, 1865, President Johnson, by a proclamation, declared the restrictions on commercial intercourse with Florida removed. A state convention assembled in October at Tallahassee, which repealed the ordinance of secession. Civil government was practically resumed the following year by the election of state officers and a legislature. A subsequent state convention met at Tallahassee, Jan. 20, 1868, to form a new constitution which was ratified by the people in May. In 1876 the election of Rutherford B. Hayes, Republican, as president of the United States, was determined by the electoral votes of Florida and Louisiana, which, by a decision of the extraordinary commission created by Congress, were counted for the former. Since 1876 the state has consistently gone Democratic. Population 1909, 683,000.

FLO'RES, the most westerly island of the Azores, about 30 miles long by nine miles broad, with a hilly surface. The chief products are wheat, pulse and poultry, and great numbers of small cattle are reared. Pop. about 10,000.

FLORID GOTHIC, that highly-enriched variety of Gothic architecture which prevailed in England in the 15th and at the beginning of the 16th century; often called the *Tudor style*, as it prevailed chiefly during the Tudor era.

FLORIDA, GULF OF, the narrow sea between Florida, Cuba, and the Bahama Islands.

FLORIDA KEYS. See Florida.

FLOSS-SILK, the portions of ravelled silk broken off in reeling the silk from the cocoons, carded and spun into a soft coarse yarn, and used for common fabrics, embroidery, etc.

FLOTOW (flō'tō), Friedrich Adolphus von, German musical composer, born 1812, died 1883. He studied music in Paris, but his earlier operas did not find favor with the Parisian opera-house directors, so he had to content himself with performances in the aristocratic private theaters. He was director of the court theater at Schwerin from 1855 to 1863; the last years of his life were chiefly spent at Vienna.

FLOTSAM, Jetsam, and Ligan, in law. Flotsam, or floatsam, is derelict or shipwrecked goods floating on the sea; jetsam, goods thrown overboard which sink and remain under water; and ligan, goods sunk with a wreck or attached to a buoy, as a mark of ownership. When found such goods may be returned to the owner if he appear; if not, they are the property of the state.

FLOUNDER, one of the most common of the flat-fishes, is found in the sea and

Four-spotted flounder.

near the mouths of large rivers. Flounders indeed have been successfully transferred to fresh-water ponds. They feed upon crustacea, worms, and small fishes, and are much used as food. The Argus-flounder is a native of the American seas.

FLOUR, the edible part of wheat, or any other grain, reduced to powder, and separated from the bran and the other coarser parts by sifting. The quality of flour depends principally on the fineness of the sieves through which it is passed and the amount of bran which it contains. The finest flour is obtained in the first grinding of the wheat. The other kinds—biscuit flour, middlings, seconds, etc.—consist of the flour which remains after the first grinding, ground and passed through coarser sieves.

FLOWER, Roswell Pettibone, American capitalist and politician; was born in 1835 in Jefferson county, N. Y. His ability as a financier was proved before removing to New York in 1869, where he soon became a recognized power in Wall Street, and was made director in various corporations. In 1881 he was elected by the democratic party to congress, and was governor of the state for the term of 1892–94. His many benevolences include the building in New York City of the Flower Hospital and of Saint Thomas' Home. He died in 1899.

FLOWER, in popular language, the blossom of a plant, consisting chiefly of delicate and gaily-colored leaves or petals; in botany, the organs of reproduction in a phenogamous plant. A com-

Parts of flower.

plete flower consists of stamens and pistils together with two sets of leaves which surround and protect them, the calyx and corolla. The stamens and pistils are the essential organs of the flower. They occupy two circles or rows, the one within the other, the stamens being in the outer row. The stamens consist of a stalk or filament supporting a roundish body, the anther, which is filled with a powdery substance called the pollen. The pistil consists of a closed cell or ovary at the base, containing ovules, and covered by a style which terminates in the stigma. These organs are surrounded by the corolla and calyx, which together are called the floral envelope, or when they both display rich coloring the perianth. The leaves of the corolla are called petals, and those of the calyx fepals. Some flowers want the floral envelope, and are called achlamydeos; others have the calyx but are without the corolla, and are called monochlamydeous. Flowers are generally bisexual, but some plants have unisexual flowers; that is, the pistils are in one flower and the stamens in another. See also Botany. The figure shows the common wallflower: a, peduncle; b, calyx; c, corolla; d, stamens; e, pistil.

FLOWER-DE-LIS. See Fleur-de-lis.

FLOWERS, Artificial, imitations of real flowers, made of various materials. These are not a modern invention. The Romans excelled in the art of imitating flowers in wax, and in this branch of the art attained a high degree of perfection. The Egyptian artificial flowers were made of thin plates of horn stained in different colors, sometimes also of leaves of copper gilt or silvered over. In modern times the Italians were the first to acquire celebrity for the skill and taste they displayed in this manufacture but they are now far surpassed by English and French manufacturers, but more especially by the latter.

FLOWERS, Language of:

Anemone — Frailty, anticipation.	Goldenrod — Encouragement.
Apple-blossom—Preference.	Heliotrope — Devotion.
Buttercups—Riches.	Honeysuckle — Fidelity.
Calla — Magnificent beauty.	Hyacinth—Sorrow.
Candytuft — Indifference.	Lilac—Fastidiousness.
Cowslip — Youthful beauty.	Marigold—Contempt.
Daffodil—Unrequited love.	Lily — Majesty, purity.
Dandelion—Coquetry	Narcissus—Self-love.
Forget-me-not—True love.	Pansy—Thoughts.
Foxglove — Insincerity.	Poppy—Oblivion.
Geranium—Deceit.	Snow-drop — Friend in need.
Gentian — Virgin pride.	Sweet-William — Gallantry.
	White Violet — Modesty.

FLOWERS, STATE, the following are "State Flowers" as adopted in most instances by the vote of the public school scholars of the respective states:

Alabama	Golden Rod
Arkansas	Apple Blossom
California	Eschscholtzia
Colorado	Columbine
Delaware	Peach Blossom
Idaho	Syringa
Illinois	Rose
Indiana	Corn
Iowa	Wild Rose
Kansas	Sunflower
Kentucky	Golden Rod
Louisiana	Magnolia
Maryland	Golden Rod
Michigan	Apple Blossom
Minnesota	Moccasin
Mississippi	Magnolia
Missouri	Golden Rod
Montana	Bitter Root
Nebraska	Golden Rod
New York	Rose
North Dakota	Wild Rose
Ohio	Scarlet Carnation
Oregon	Oregon Grape
Pennsylvania	Golden Rod
Rhode Island	Violet
South Dakota	Pasque
Texas	Blue Bonnet
Utah	Sego Lily
Vermont	Red Clover
Washington	Rhododendron
West Virginia	Rhododendron

In England the primrose is worn on the birthday of Lord Beaconsfield. On the anniversary of Parnell's death his followers wear a sprig of ivy. The Jacobites wear white roses on June 10. In France the Orleanists wear white daisies and the Bonapartists the violet.

FLUID, a body whose particles on the slightest pressure move and change their relative position without separation; a liquid or a gas, as opposed to a solid. Fluids are divided into liquids, such as water and bodies in the form of water; and gaseous bodies or aeriform fluids. Liquids have been also termed non-elastic fluids, for although they are not altogether void of elasticity, they possess it only in a small degree. Air and aëriform bodies have been called elastic fluids on account of their great elasticity.

FLUORES'CENCE, a name given to the phenomena presented by the invisi-

ble chemical rays of the blue end of the solar spectrum when they become luminous and visible by being sent through uranium glass, or solutions of quinine, horse-chestnut bark, or Datura Stramonium. In this way green crystals, as of fluor-spar, may give out blue rays, due not to the color of the surface of the body, but to its power of modifying the rays incident on it. The phenomenon appears to be identical with phosphorescence. It is due to the refrangibility of the rays being lowered or degraded by the action of the substance. The term fluorescence is applied to the phenomenon if it is observed while the body is actually exposed to the source of light; phosphorescence to the effect of the same kind, but usually less intense, which is observed after the light from the source is cut off. Both forms of the phenomenon occur in a strongly-marked degree in the same bodies.

FLU'ORIDE, in chemistry, a compound obtained by heating hydrofluoric acid with certain metals, by the action of that acid on metallic oxides or carbonates, by heating electro-negative metals, as antimony, with fluoride of lead or fluoride of mercury, and in other ways.

FLU'ORINE, a very widely distributed element, which is known chiefly only in combination, though it has recently been isolated by De Moissan as a colorless gas, that attacks almost every substance and is the most active element known. Its most abundant compound is calcic fluoride, which not only exists in the mineral kingdom as fluor-spar (which see), but forms an essential part of the bones and teeth of animals. Fluorine has also been detected in the blood, milk, and urine; in plants; in volcanic sublimates; in rocks; in coprolites and mineral phosphates; and in a variety of minerals. Combined with hydrogen it forms hydrofluoric acid.

FLUOR-SPAR, DERBYSHIRE SPAR, or **FLUORINE,** fluoride of calcium, a common mineral found in great beauty in various localities. It generally occurs massive, but crystallizes in simple forms of the monometric system—viz. the cube, octahedron, dodecahedron, etc., and in combinations of the cube and octahedron. Pure fluor-spar contains 48·7 per cent fluorine, 51·3 calcium. It is of frequent occurrence, especially in connection with metalliferous beds, as of silver, tin, lead, and cobalt ores. It is sometimes colorless and transparent, but more frequently it exhibits tints of yellow, green, blue, and red.

FLUTE, a portable musical instrument, consisting of a tube furnished with six holes for the fingers, and from one to fourteen keys which open other holes. The sound, which is soft and clear in quality, is produced by blowing with the mouth into an oval aperture at the side of the thick end of the instrument. Its useful compass is about two and a half octaves, including the chromatic tones. It is usually made in four pieces, and of box or ebony, sometimes, however, of ivory, silver, or even of glass.

FLUTING, in architecture, channels or furrows cut perpendicularly in the shafts of columns. It is used in the Doric, Ionic, Corinthian, and Composite orders, but never in the Tuscan. When the flutes are partially filled up by a smaller round molding they are said to be cabled.

FLY, a winged insect of various genera and species, whose distinguishing characteristics are that the wings are transparent and have no cases or covers. By these marks flies are distinguished from beetles, butterflies, grasshoppers, etc. The true flies or Diptera have only two wings, viz.: the anterior pair. In common language, fly is the house-fly, of the genus Musca. The house-fly is found wherever man is, and in hot weather causes a good deal of annoyance. It is furnished with a suctorial proboscis, from which, when feeding on dry substances, it exudes a liquid, which, by moistening them, fits them to be sucked. From its feet being beset with hair, each terminating in a disc which is supposed to act as a sucker, it can walk on smooth surfaces, as a ceiling, even with its back down. The female lays her eggs in dung or refuse; the larvæ are small white worms. They change into pupæ without casting their skins, and in from eight to fourteen days the perfect fly emerges. The very small flies and the very large ones seen about houses belong to other species. See Blow-fly, Bot-fly, Gad-fly.

FLY-CATCHER, a name originally given to certain insessorial birds with a bill flattened at the base, almost triangular, notched at the upper mandible, and beset with bristles, about the size of

White-collared fly-catcher.

a sparrow. They perch on a branch, where they remain immovable watching for insects, only leaving to make a sudden dart at a passing fly, which they seize with a snap of the bill, and then return. The white-collared fly-catcher is a native of southern Europe. Numerous other birds receive the name of fly-catchers, and some, as the paradise fly-catchers of the Old World, are brilliantly colored. In America some of the tyrant birds are named fly-catchers.

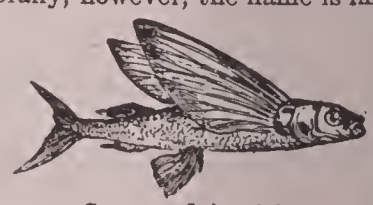
FLYING, the power of locomotion through the air, possessed by various animals in different degrees. Birds, bats, and many insects can raise themselves into the air and sustain themselves there at will. Squirrels, phalangers, some lizards, one of the tree-frogs, and flying-fish can move through the air in one direction for a short time, but cannot, strictly speaking, fly. The wing of a bird or insect is an elastic flexible organ, with a thick anterior and a thin posterior margin; hence the wing does not act like a solid board, but is thrown into a succession of curves. When a bird rises from the ground it leaps up with head stuck out and expanded tail, so that the body is in the position of a boy's kite when thrown up. The wings are strongly flapped, striking forward and downward, and the bird quickly ascends. It has been shown that the wing describes a figure of 8 in its action, the margin being brought down so that the tip of the wing gives the last blow after the part next the trunk has ceased to strike; hence, standing in front of a bird, the wing would be divided into two, the upper surface of one half and the lower surface of the other being visible at the same time. These portions are reversed when the wing is drawn back and toward the body, before beginning another stroke; but it will be observed that during retraction the wing is still sloped, so that the resemblance to a kite is maintained. There are many varieties of flight among birds; of these the most remarkable is the sailing motion, in which the wings are but slightly moved. Probably the original impetus is maintained by the kite-like slope of the wing, and advantage may be taken of currents by a rotation of the wing at the shoulder, a movement invisible at any distance.

FLYING, Artificial. See Aeronautics.

FLYING-BRIDGE, a bridge made of pontoons, light boats, hollow beams, casks, or the like. They are made as occasion requires, chiefly for the passage of troops. The term is also applied to a kind of ferry in which the force of the current of a river is applied to propel a boat guided by a cable fastened from the one side to the other.

FLYING DUTCHMAN, a phantom ship said to be seen in stormy weather off the Cape of Good Hope, and thought to forebode ill luck. One form of the legend has it that the ship is doomed never to enter a port on account of a horrible murder committed on board; another, that the captain, a Dutchman, swore a profane oath that he would weather the cape though he should beat there till the last day. He was taken at his word, and there he still beats, but never succeeds in round the point.

FLYING-FISH, a name common to various fishes which have the power of sustaining themselves for a time in the air by means of their large pectoral fins. Generally, however, the name is limited



Common flying-fish.

to mackerel-pikes. The pectoral fins, which are very large, are the principal instruments in their flight, serving to sustain the fish temporarily in the air after it has acquired an initial velocity in its rush through the water. It can pass through the air to a considerable distance, sometimes as much as 200 yards, which it does to escape from the attacks of other fishes, especially the dolphin. It is most common between the tropics.

FLYING-LEMUR, a name given to insectivorous mammals, natives of the Indian Archipelago. They possess a flying membrane, which extends as a broad expansion from the nape of the neck to the tail. By means of this mem-

brane they can take extended leaps from tree to tree.

FLYING-SQUIRREL, a genus of rodent animals (squirrels), to which the skin of the flank, extending between the

European flying-squirrel.

fore and hind legs, imparts the faculty of supporting themselves for a moment in the air, as with a parachute, and of making very great leaps.

FLY-WHEEL, a wheel with a heavy rim placed on the revolving shaft of any machinery put in motion by an irregular or intermitting force, for the purpose of rendering the motion equable and regular by means of its momentum. A fly-wheel is also used as an accumulator of force; thus, when a small steam-engine sets in motion a very large fly-wheel, the wheel acts as a reservoir of all the small pressures which have been communicated to it, and having thus concentrated them can apply them all together and at once when some great effect is to be produced.

FO, the Chinese name of Buddha. See Buddha.

FOCUS, (1) in optics, a point in which any number of rays of light meet after being reflected or refracted by a mirror or a lens. (2) In geom. an important point on the principal axis of the parabola, ellipse, and hyperbola. The ellipse and hyperbola have each two foci, the parabola one, though in the latter case we may suppose a second focus at an infinite distance. The foci were so called from the fact that rays of light proceeding from one focus and reflected from a corresponding reflecting surface pass through the other focus.

FŒTUS. See Fetus.

FOG, a cloud at or near the surface of the earth, produced by the condensation of the invisible vapor of the atmosphere into minute watery particles, this condensation being caused by a cold current of air, or the contiguity of a cold surface.

FOGGIA (foj'à), a town of S. Italy, province of Foggia, 79 miles n. e. of Naples, with regular and spacious streets. Pop. 53,351.—The province, which is partly bounded by the Adriatic, has an area of 2954 sq. miles. It possesses rich pastures, and produces saffron, wine, etc. Pop. 418, 510.

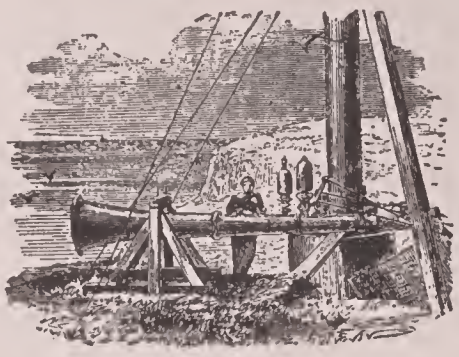
FOG-SIGNALS, signals given by means of sound to warn vessels during fogs, when lights or other visible signals cannot be perceived. Various kinds of fog-signals are used, among which may be mentioned bells, drums, gongs, guns, compressed-air whistles, steam-whistles, and fog trumpets or horns.

FOIL, a thin leaf of metal, as gold or tin, used for various purposes.

FOIL, in fencing, a rod of steel, representing a sword, with a handle or hilt at one end, and a leather button at the other to prevent accidents. Foils measure from 31 to 38 inches in length.

FOKIEN, a maritime province of Southeastern China; area, 46,320 sq. miles, The strait of Formosa separates it from the island so named The principal products are rice, wheat, barley, tea, silk, sugar, indigo, camphor, and tobacco. The capital is Foo-chow. Pop. 25,790,556.

FOLC-LAND, that is Folkland, the land of the people, that portion of Anglo-Saxon England which was retained on behalf of the community. See Feudal System.



Siren fog-horn.

FOLK-LORE, a useful term of recent introduction into the English language, signifying a scientific study of popular tales, traditions, primitive beliefs and superstitions, popular customs, usages, festivals, games, etc. Folk-lore, though it takes cognizance of many apparently trivial matters, is of great importance in the science of comparative mythology, and helps to throw much light on the relationships between races, and on the origin and development of religious beliefs and ceremonies.

FOMENTATION, in med. the application of warm liquids to a part of the body, by means of flannels or other cloths dipped in hot water or medicated decoctions, for the purpose of easing pain by relaxing the skin or of discussing tumors.

FOND DU LAC, a city in Wisconsin, at the mouth of Fond du Lac River, which opens on Lake Winnebago, 148 miles n. n. w. of Chicago. It is the center of several railways, and has a large trade. The manufactures include iron-founding, carriage and wagon making, tanning, saw-milling, etc. Pop. 18,210.

FONT, the vessel which contains the water for baptism in a church. It is frequently sculptured in stone or marble, with richly decorative designs.

Font, Cathedral of Langres, France, end of 13th century.

FONTAINE, Jean de la. See La Fontaine.

FONTAINEBLEAU (fon-tān-blō), a town of France, dep. Seine-et-Marne, in the midst of the forest of same name, about 2 miles from the Seine and 37 miles s.s.e. Paris. It owes its origin chiefly to the palace, and is a quiet place, with broad, clean streets. Pop. 13,340. The castle or palace of Fontainebleau is one of the most magnificent in France. It occupies the site of a fortified chateau founded by Louis VII. in 1162; this was converted into a magnificent palace by Francis I.; much added to by Henry IV., Napoleon I., Louis Philippe, and Napoleon III. The park is laid out like a vast garden, and adorned with statues, temples, fountains, lakes, and waterfalls. The forest, which is about 50 miles in circumference, covers an area of 42,500 acres, affords numerous pleasant walks, and abounds with game.

Palace of Fontainebleau.

FONTENOY, a village in Belgium, province of Hainaut, celebrated for the battle of May 11, 1745, in which the French under Marshal Saxe defeated the British, Austrian, and Dutch allied forces under the Duke of Cumberland.

FOO-CHOW, a town of China, capital of the province of Fokien, on the Min, 125 miles n. e. of Amoy. Pop. estimated at 630,000.

FOOD. See Aliment and Dieteties.

FOOD, PRESERVATION OF, from earliest times man's thoughts have been occupied in devising ways and means to prevent articles of food from deterioration or putrefaction. In their natural state most foods are seasonable only during limited periods of the year, and their consumption is restricted to certain localities. Their preservation in such a manner as to make them palatable during the entire year, in all localities, has been the subject of much research.

Independent experiments by such well-known scientists as Cagnaird de la Tour, Schwann, Helmholtz, Pasteur, Schultz, and others established beyond a doubt that the decomposition of food is due to the presence of a living organism known as "ferment." It was reasoned that anything that would kill this organism or preclude its presence would preserve the article treated. The known processes that will accomplish this result, and at the same time preserve the food, are desiccation, use of antiseptics, refrigeration, and canning. Desiccation, or drying, was undoubtedly the first method used, but food preserved by this means loses much of its natural flavor and becomes tough in texture. The same objection arises in the use of antiseptics. Refrigerated foods, unless great care is exercised in the thawing, are not palatable.

Prior to 1795, drying and the use of salt and sugar were the only methods used to any extent in the preservation of foods. At this time Nicholas Appert, a Frenchman, who had spent most of his life in the preparation and preservation of articles of food, being stimulated in his work by the offer of a reward by the French navy department for a method of preservation of foods for sea-service, submitted to his government an exhaustive treatise bearing upon the hermetic sealing of all kinds of food. His method was to inclose fruit in a glass jar, which was then corked, and subjected to the action of boiling water for a time, varying according to the nature of the article treated. A description of his process can be best summed up in his own words, as follows: "It is obvious that this new method of preserving animal and vegetable substances proceeds from the simple principle of applying heat in a due degree to the several substances after having deprived them a as much as possible of all contact with the external air. It might, on the first view of the subject, be thought that a substance, either raw or previously acted upon by fire, and afterward put into hot bottles might, if a vacuum were made in those bottles and they were completely corked, be preserved equally well with the application of heat in the water bath. This would be an error, for all trials I have made convince me that the absolute privation of the contact of external air (the internal air being rendered of no effect by the action of heat) and the application of heat by means of the water bath, are both indispensable to the complete preservation of alimentary substances." Time has proved this method to be the most satisfactory for preserving food in its natural state. France purchased his process and gave it to manufacturing firms in France and England for the production of the goods. By this means the industry gradually spread over England, Ireland, and France.

In the year 1810 Peter Durant secured a patent from the English government for the preservation of fruits, vegetables, and fish in hermetically sealed tin and glass cans. He did not claim to be the discoverer of the process, but said that it had been communicated to him by a "foreigner residing abroad." The secret of the process was jealously guarded, but the employees of the different establishments became more or less familiar with its essentials, and in this manner the industry found its way to America.

One of the first men to come to America with a knowledge of the process gained in its actual use was Ezra Daggett, who arrived in New York some time between the years 1815 and 1818. In the year 1819 he and his son-in-law, Thomas Kensett, were engaged in the manufacture of hermetically sealed goods, the principal foods packed being salmon, lobsters and oysters. In the following year the industry was launched in Boston by William Underwood and Charles Mitchell, emigrants from England, where they had been employed in canning establishments. Their principal business however, during the early days of their establishment, was the preparations of pickles, sauces, jellies, jams, and mustard; but they also canned damsons, quinces, cranberries, and currants. The industry also owes much to Allen Taylor, an Englishman, and M. Gallagher, an Irishman, both of whom learned their trade at Sligo, Ireland, the latter having in his possession a copy of Appert's treatise on the subject of canning. These men came to America at about the time as those mentioned above, and were for a time employed in New York. Prior to 1840 the industry was established in Baltimore, and Kensett, Taylor and Gallagher did much to place it upon a permanent basis.

Glass jars were gradually abandoned, as it was found that they could not withstand the extremes of temperature and were expensive, bulky, and costly in transportation. In 1825, Thomas Kensett secured a patent on the use of tin cans in preserving food, and in the same year began using the patented process in his factory. Tin has been the favorite material for the construction of cans. Their early manufacture was by hand and very crude, the bodies being cut with shears and the side seam made with a plumb joint (that is, meeting, but not overlapping) and then soldered together. Heads were made to set into the body, and were soldered in place in a very crude manner. The construction of the cans was slow and costly, the making of 100 being considered a good day's work. In 1847 Allen Taylor invented the stamp can, which proved a decided improvement over the plumb-joint can just described, and about two years later Henry Evans, jr., of New Jersey, invented the "pendulum" press for making can tops. The latest important improvement in can manufacture was the invention of the key-opening can, which by the genius of a Mr. Zimmerman has been so reduced in cost that it has come into general use.

Can making is now a distinct industry, and not usually carried on, as formerly, in connection with the actual canning of the foods. It is estimated, however, that about 10 per cent of the cans are still made by the canning establishments. For the past fifteen years labor-saving machines have been introduced in can manufacture until now all the parts are made and put together by mechanical devices. The tin cans are made from Bessemer steel plates cut into sheets 14 by 20 inches and weighing about one pound. They are then subjected to an acid to remove all dirt, grease, scales, etc., and coated with pure tin by the acid process or the palm-oil process, the latter being the safer and better of the two methods. The objection having been urged against the use of tin cans that the natural acids of fruits, vegetables, meats, and fish act upon the tin and solder in such a way as to form metallic salts or metallic compounds that are injurious to the health; the matter was carefully investigated by expert chemists, who reported that the objection is groundless if good tin is used. In the poorer grades of tin injurious substances were found, but in such small quantities that they were of no consequence.

By the Appert process the goods were cooked in open kettles, the highest temperature obtainable by this method being 212° F., or the temperature of boiling water. The process was necessarily slow, but gradually improvements were made in the methods and a higher degree of temperature was obtained by the addition of common salt to the water. This innovation was followed by the use of chloride of calcium, which made possible a temperature of 240° F. The cans, however, under this process become discolored, involving considerable expense in cleaning them to make the goods merchantable. In 1874 Mr. A. K. Shriver, of Baltimore, invented a closed-process kettle to cook the goods by superheating water with steam. About the same time Mr. John Fisher, of the same city, invented a patent-process kettle which secured the same results by the use of dry steam. By these methods, which are used at the present time, any desired temperature can be obtained and the heat regulated to meet requirements.

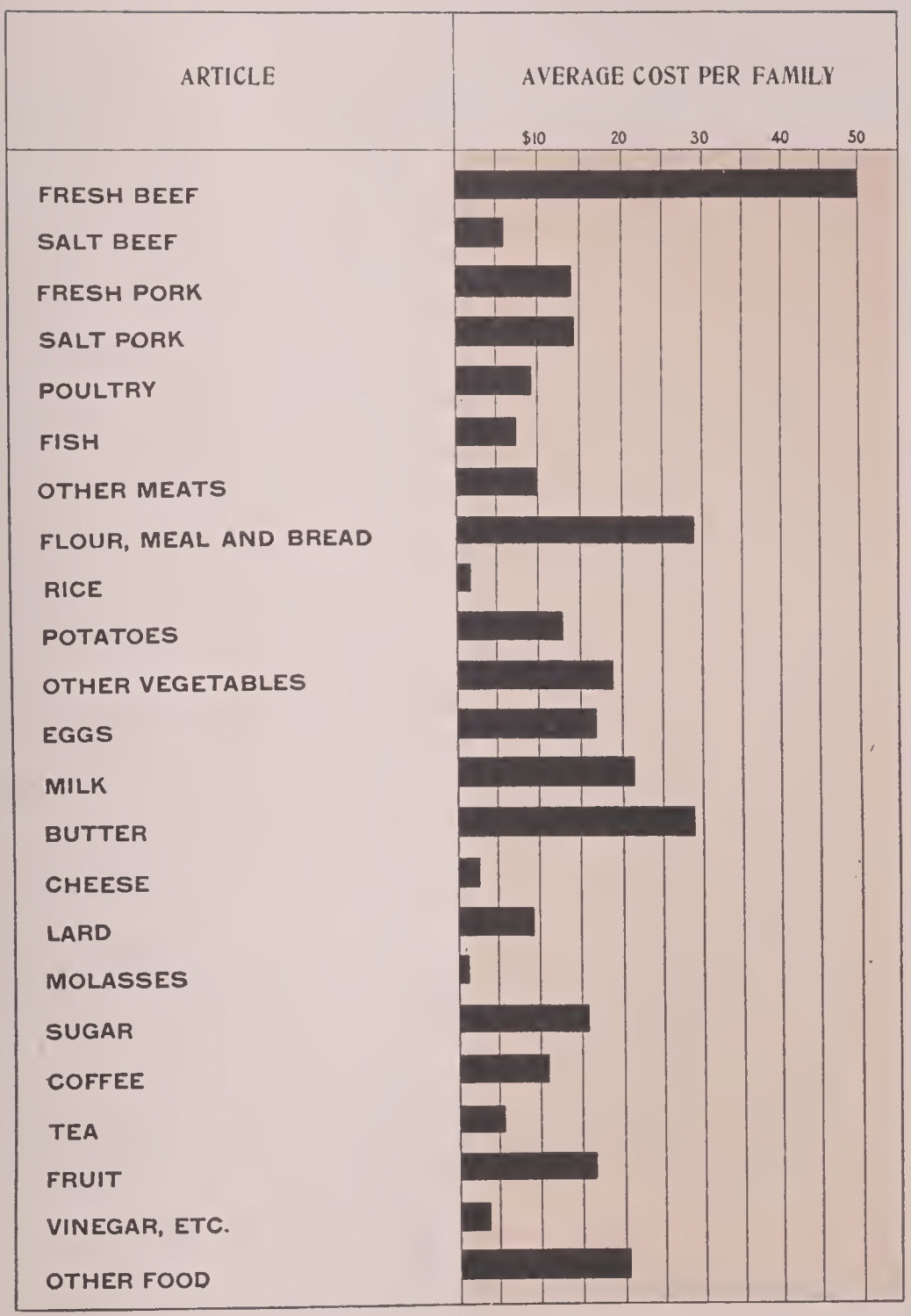
The use of antiseptics in the preservation of food in its simplest form is found in the employment of salt or strong brine to kill the bacteria and this is the method employed from primitive times in curing meat or fish. More dangerous, however, are the other antiseptics. The U. States department of agriculture has recently issued strong warnings against the use of formaldehyde, salicylic acid, sulphites, borax and benzoic acid. Their use is, however, almost universal although their danger is recognized by the national pure food laws which provide that preserved foods containing such substances shall be labeled in accordance with the preservatives used. The use of salicylic acid and sulphites

Several distinguished seientists have reeently pointed out that as the demand of the white raees for wheat as a foodstuff increases, the aereage devoted to wheat growing increases, but at a less rapid rate, and being limited by climatie eonditions will in a few years, be entirely taken up. Then, there will be a wheat famine unless the world's yield per aere ean he raised by the use of fertilizers. Of sueh fertilizers the chief is nitrate of soda exported from the nitre beds in Chili and the supply will at the present rate be exhausted in less thau fifty years. Then the only ehanee of averting starvation lies through the laboratory

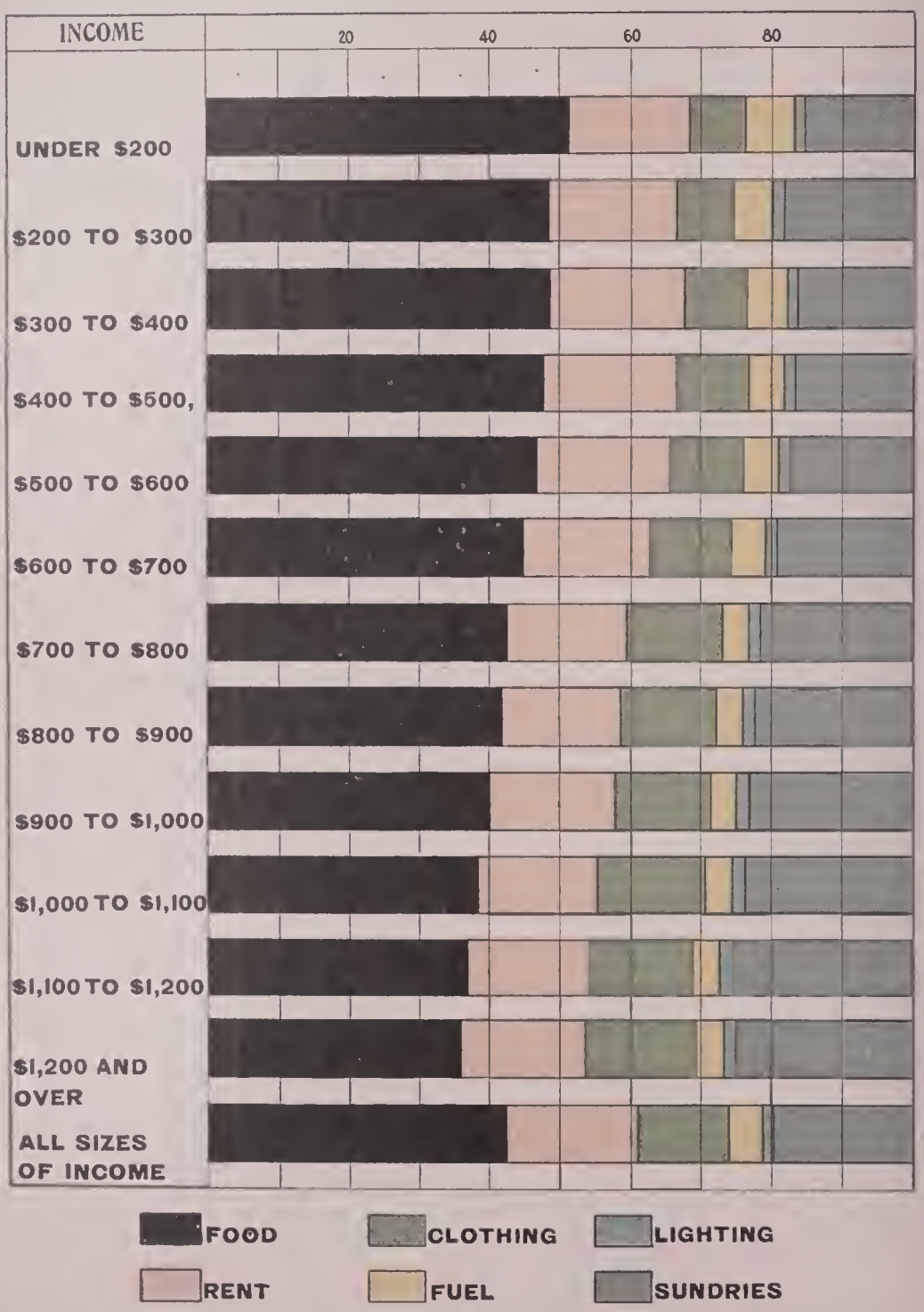
Sir William Crookes has demonstrated that nitrogen eould be obtained from the atmosphere by passing air through an eleetric are flame. This proeess has now entered the commereial stage in Norway, nitric aeid and nitrate of lime being formed in large quantities. The meehanieal and chemical means whieh the future may have to employ in the produetion of its daily bread are shown in the engraving. The huge ears of wheat ean be seen growing in long glazed alleys, while strange lights are blazing from many points

AVERAGE COST PER FAMILY OF CERTAIN ARTICLES OF FOOD

FROM REPORTS OF 2,567 AMERICAN FAMILIES



PER CENT OF TOTAL EXPENDITURE MADE FOR VARIOUS PURPOSES IN NORMAL FAMILIES, BY SIZE OF INCOME



is forbidden by many governments as being generally regarded as more dangerous than the benzoic acid and borax.

Cold storage, the most modern method of preserving food dates from the last quarter of the 19th century In this process the use of other preservatives than cold is unnecessary. The subject is discussed in the article on refrigeration and its economic importance will be realized upon consulting the article devoted to the Packing Industry.

FOOL. See Jester.

FOOLS, Feast of, the name given to festivals regularly celebrated, from the 5th to the 16th century, in several countries of Europe, by the clergy and laity, with the most absurd ceremonies.

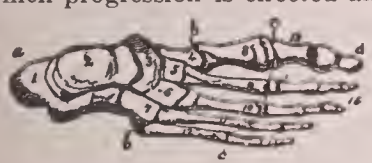
FOOLSCAP, paper of the smallest regular size but one (13 by 16 inches); so called from its water-mark in early times being the outline of a fool's head and cap.

FOO-SHAN, a town, China, prov. of Quangtong, 21 miles s. w. of Canton, on one of the branches of the delta of the Si-kiang. Pop. 200,000.

FOOT, a measure of length, the name of which is derived from the length of the human foot, containing 12 linear inches.—Square foot is a square whose side is one foot ,and is therefore equal to 144 square inches.—Cubic foot is a cube whose side is 1 foot, and the cube contains 1728 cubic inches. The foot is a common measure in various countries, but its dimensions vary considerably.

FOOT, in prosody, a measure consisting of a variety of syllables, two, three, or four, in combinations of long and short, or accented and unaccented. In Greek and Latin verse the feet depend on the quantity or length of the syllables each foot having a distinctive name—trochee, iamtris, dactyle, anapest, etc. The same are applied to English measures, an accented syllable in English being held to be equivalent to a long syllable in Latin or Greek, and an unaccented syllable to a short.

FOOT, in animals, the lower extremity of the leg; the part of the leg which treads the earth in standing or walking, and by which the animal is sustained and enables to step; or that surface of the body by which progression is effected among



Skeleton of the human foot.

a to *b b*, Tarsus. *b b* to *c c*, Metatarsus. *c c* to *d*, Phalanges. 1, Os calcis, calcaneum, or heel-bone. 2, Astragalus 3, Scaphoid bone. 4, Inner cunoid bone. 5, Middle cunoid bone. 6, Outer cunoid bone. 7, Cuboid bone. 8 to 12, Metatarsal bones. 13, First row of phalanges. 14, Last row of phalanges.

the mollusca. The foot of man is composed of twenty-six bones, seven of which constitute the tarsus or ankle, which articulates with the leg and corresponds to the carpus (wrist). Five bones form the metatarsus, which corresponds to the metacarpus, and articulates with the tarsus, behind, and with the toes in front. The foot is narrow and thick in its posterior part, thinner and broader anteriorly; it forms a right angle with the leg, and rests upon the ground at the extremities only. The middle portion is in the form of an arch, and, in consequence, resists shocks and supports pressure much better than it could if it were flat and touched the ground throughout its whole length.

FOOTA, a territory of Senegambia, W. Africa, on the lower Senegal, which bounds it on the northeast. It includes Foota Toro, and other districts. Area, about 15,000 sq. miles; pop. estimated at 400,000.

FOOTA-JALLON, a region of West Africa, intersected by lat. 11° n. and lon. 11° w. It is governed by an elective chief under the protection of France.

FOOT-AND-MOUTH DISEASE, a highly contagious eczematous affection which attacks the feet and mouths of cattle, manifesting itself by lameness, indisposition to eat, and general febrile symptoms, with ultimately eruptions of small vesicles on the parts affected, and general indisposition of the animal. The disease occasionally spreads to the udder of milch-cattle, and it is believed that it may be communicated to persons who drink the milk of cows so affected.

FOOTBALL, an outdoor game of considerable antiquity. In former times towns and villages were often matched against each other, the whole of the able-bodied inhabitants taking part in the struggle; the goals being often miles apart, and usually consisting of natural objects, as a brook or river. The modern form of the game is played by two parties of players, on a large level piece of ground, generally oblong in shape, and having in the middle of either of the ends a goal formed by two upright posts 6 to 8 yards apart, with a bar or tape extended between them at the height of 8 or 10 feet from the ground. There are various styles of playing the game, but those recognized in important matches are the Rugby, the Football Association and the American Association game. In both games the main object is for either party to drive the ball (which is kicked off in the center of the field) through the goal that their opponents are guarding, and thus count a goal against them. In the Rugby game the goal-posts are 18½ feet apart, and joined by a cross-bar at a height of 10 feet from the ground; and to score a goal the ball must be kicked over this bar by one of the opposite side. In the Association game the upright poles are 8 yards apart, and joined at 8 feet from the ground by a tape, under which the ball must pass to secure a goal. The Rugby game is much rougher and less scientific than the Association game which discourages rough play and relies mainly on the skilful manœuvring of the ball with the feet, it being forbidden to touch the ball with the hands; while by the Rugby rules the player may catch the ball in his hands, run with it, and kick it dropping. A regular game lasts an hour and a half, and at half-time the teams change ends in order that inequalities of situation may be neutralized.

The American Game.—The rules of the English Rugby Union, as they were in 1875, were adopted as the foundation of the American game; but in 1876 they were revised, so that in place of the former play the man who happened to have the ball when a "down" was made played it to one particular man—the "snap-back," and its destination then becomes part of a preconcerted and well-rehearsed play. He puts the ball in play behind him, and the men in his line act in concert, in a general, prearranged attack on the enemy's line, with the object of clearing a path for the man who runs with the ball. The work of the rushers has been specialized, light men put where their qualifications are most effective, and heavy men in the same way; end men selected who could make runs and free catches off short kicks. In the same way, guards to protect the quarter-back when he passed the ball, and tackles to break up the opponents' play, were early specifically selected for qualifications and specialized for the work. Every year has brought new plays to the fore, and every rule has been the subject of infinite thought on the part of the players, mainly to design some method of meeting them, each play in its turn resulting in still new rules—to wit, the "block system" of the early eighties was met by "the five-yard rule," designed to prevent one side keeping possession of the ball unduly, without material advance or retreat, by enacting that if in three "downs," or attempts to advance the ball, the side doing so has not made 5 yards toward the opponent's goal, or retreated 20 yards toward their own goal, they should surrender possession.

"Interference" was restrained but developed into "mass plays"—the grouping of a body of men some distance back of the line and starting them before the ball was put in play. This tendency called into existence the rules committee of the University Athletic Club, whose annual revisions have aimed at the greater protection of a man on a fair catch, and the encouragement of kicking and of a more open game generally. The time of play is two halves of thirty-five minutes each, with ten minutes intermission. Any player injured can be removed from the field and another player substituted, in which respect the American game differs from the British play, where each team has to play the game out with the members with which which they start the game, or such of them as are capable of play. These differing rules may account for the marked difference in the casualties in the field; a captain who has no reserves takes more care of his men than he who can replace an injured player with a substitute.

FOOTE, Andrew Hull, a distinguished officer of the U. States navy; was born in New Haven, Conn., in 1806. He was commissioned lieutenant on May 27, 1830; from 1837 to 1840 was executive officer of the John Adams, of the East India Squadron, during its cruise around the world, and from 1841 to 1843 was stationed at the Naval Asylum in Philadelphia, of which during the last two years he was in full charge. In 1852, he was promoted to the rank of commander. On February 6, 1862, he captured Fort Henry, and on the 14th he attacked Fort Donelson, before

which Grant with his army had arrived two days earlier; but was repulsed, and he himself was wounded. For several months in 1862–63 he was chief of the bureau of equipment and recruiting, and on June 4, 1863, was appointed to succeed Rear-Admiral Dupont as commander of the fleet off Charleston, but died at New York, on June 26, 1863.

FOOT-GUARDS. See Guards.

FOOT-LIGHTS, in theaters, the row of lights placed on the front of the stage and on a level with it, to light it up.

FOOT-POUND, in physics, the term expressing the unit selected in measuring the work done by a mechanical force. A foot-pound represents 1 lb. weight raised through a height of 1 foot; and a force equal to a certain number of foot-pounds, fifty for example, is a force capable of raising 50 lbs. through a height of 1 foot.

FOOT-ROT, a disease in the feet of sheep, the more common form of which is an inordinate growth of hoof, which at the toe, or round the margin, becomes turned down, cracked, or torn, through affording lodgment for sand and dirt. In the second form of the disease the foot becomes hot, tender, and swollen; there are ulcerations between the toes, followed by the sprouting of proud flesh.

FOR'AKER, Joseph Benson, American politician and legislator, born at Rainsboro, Ohio, in 1846. He studied law and was admitted to the bar at Cincinnati, where he practiced with success until 1879, when he was elected a judge of the superior court. He resigned from the bench in 1882, and in 1885 was elected governor of Ohio on the Republican ticket. He was reelected in 1887, and was defeated for a third term, in 1889, by James E. Campbell, although all the rest of the republican state ticket was elected. From his defeat as governor in 1889 to 1897 he was engaged actively in the practice of law at Cincinnati gaining a reputation as a corporation attorney. In 1897 he became United States senator, and was re-elected in 1902. In the senate he has taken an active and aggressive part in the debates, being one of the most radical advocates in that body of the war with Spain in 1898.

FORBES, James David, Scottish scientist born 1809, died 1868. His fame rests chiefly on his study of glaciers. See Glaciers.

FORBIDDEN FRUIT, a name fancifully given to the fruits of various trees grown in tropical countries, as the shaddock, a sort of thick-skinned orange, and the poisonous fruit of a tree of Ceylon, traditionally said to be the fruit of which Adam and Eve ate at the time of the fall in Eden.

FORCE, that which is the source of all active phenomena occurring in the material world, and of which motion, gravitation, heat, light, electricity and magnetism, cohesion, and chemical affinity are believed to be exhibitions. Mechanical force is the power which produces or modifies motion or tends to do so. It has its origin in three causes: (1) gravitation; (2) the unknown cause of the phenomena of light, heat, and electricity; and (3) life. Mechanical forces are of two sorts: one of a body at rest, being the same as pressure or tension; the other of a body in motion, being the same as impetus or momentum. When two forces act on a body in the same line of direction the resulting force, or resultant as it is called, will be the sum of both forces. If they act in opposite directions the body will remain at rest if the forces be equal; or, if the forces be unequal, it will move with a force equivalent to their difference in the direction of the greater. If the lines of direction make an angle with each other the resultant will be a mean force in an intermediate direction. The composition of forces is the combining of two or more into one (actually or hypothetically), which shall have the same effect when acting in some given direction; the resolution of forces is the decomposing of a single force into two or more forces, which, acting in different directions, shall be equivalent to the single force. Forces have different denominations according to their nature and the manner in which they act; thus we have accelerating forces, constant forces, parallel forces, uniform and variable forces, etc. The unit of force is a single force in terms of which the amount of any other force is ascertained. See Dynamics, Energy.

FOR'CEPS, a general name for a two-bladed instrument on the principle of pincers or tongs, used for seizing and holding, and for extracting objects, which it would be impracticable thus to treat with the fingers.

FORCE-PUMP. See Pump.

FORCING, a method of cultivation by which plants, flowers, and fruits are raised at an earlier season than the natural one by protecting them under glass, in hot or cold frames, by using stimulating fertilizers, and other means.

FORD, John Thomson, American theatrical manager, was born at Baltimore in 1829. He was the owner of Ford's Theater, the scene of the assassination of President Lincoln by Booth on April 14, 1865, and on suspicion of complicity was arrested and imprisoned for 40 days. He was then released as absolutely no evidence was adduced against him. He was long one of the board of governors of the Maryland penitentiary and at one time president of the board of directors of the Baltimore and Ohio Railway. He died in 1894.

FORD, Paul Leicester, American historian and novelist, was born in Brooklyn, N. Y., in 1865. After traveling extensively in both hemispheres he devoted himself to investigations in the sources of American history. He edited the writings of Thomas Jefferson, the writings of Thomas Dickinson and The Federalist. These studies led to the True George Washington, The Many Sided Franklin, etc. His best known works of fiction are: Janice Meredith, Wanted: A Matchmaker, The Hon. Peter Sterling. He died in 1902.

FORD'S THEATER, a Washington theater, in which President Lincoln was assassinated by Booth, April 14, 1865. The building was purchased in 1866 by the U. States government, and was used until 1887 as the Army Medical Museum, and later as the Pension and Records Bureau of the War Department. It collapsed, with the loss of many lives, on June 9, 1893.

FOR'DUN, John, the father of Scottish history, born probably at Fordoun Kincardineshire, soon after 1300; died about 1386.

FORE-AND-AFT, in ships, a term meaning in a line with the keel. Fore-and-aft sails are those that are set on a stay or gaff and boom, such as jibs, stay-sails, etc.

FORECASTLE, a short deck in the forepart of a ship of war, or forward of the foremast, above the upper deck. In merchant ships it is the forepart of the vessel, where the sailors live.

FORECLOSURE, the process whereby a mortgagor's right, or "equity," of redemption is cut off and the mortgagee's lien on the mortgaged lands or goods enforced. It is available to the mortgagee at any time after default, and is instituted by a bill of foreclosure asking that an account may be taken of the principal and interest due under the mortgage, and that the mortgagor, on failing to pay by a specified date, may forfeit his equity of redemption. If on the day fixed for payment the money be not forthcoming, the mortgagor will be declared to have forfeited his equity of redemption, and the mortgagee will be allowed to retain the estate in perpetuity.

In a few of the American states, the mortgage has come to be regarded as a mere lien, and not as a legal estate in the mortgagee, a statutory process, known also as a foreclosure, has been adopted in lieu of the foregoing process of "strict" foreclosure. This differs from the older method principally in the fact that it involves the satisfaction of the debt, not by a forfeiture, but by a sale of the mortgaged premises. The suit, which is also in equity, is instituted by the mortgagee as plaintiff, the mortgagor and all creditors, subsequent lienors, and other parties in interest, being made defendants. The demand is for a judgment that the defendants be foreclosed and cut off from all their interest in the mortgaged premises, and that the same be sold to satisfy the mortgage debt. The sale is made upon notice and is at public auction, generally by the sheriff or a referee appointed by the court. After the sale the money in the hands of the referee will be applied to the payment of the mortgage, and any surplus may be claimed by subsequent mortgagees; or, if there is no other claim upon it, it will be paid to the mortgagor.

FOREIGN OFFICE, that department of the British government presided over by the secretary of state for foreign affairs, and having its locale in Downing street, Westminster, London. It was established in 1782, and has charge of British interests in foreign countries. The secretary for foreign affairs negotiates treaties, appoints diplomatic officers, etc.

FOREN'SIC MEDICINE, the branch of medical education which applies the principles and practice of the different branches of medicine to the elucidation of doubtful questions in a court of justice; otherwise called medical jurisprudence.

FORESHORTENING, in drawing and painting, the art of representing figures in such a manner as to convey to the mind the impression of the entire length of any object which is pointing more or

Foreshortened (after figure by Raphaël).

less directly toward the spectator standing in front of the picture. The projecting object is shortened in proportion to its approach to the perpendicular to the plane of the picture, and in consequence appears of a just length.

FOREST, a term properly applied to an extensive wood, or to a large tract of mingled woodland and open and uncultivated land; but also to a large tract of hilly or mountain land wholly or chiefly devoted to the purposes of the chase. Forests proper are of much importance in the general economy of the globe. They greatly affect climate; and their beneficial influence in a physical, economical, and hygienic aspect is now receiving increased attention. In German and various other European countries forest science constitutes a separate branch of education, but in Britain less regard is paid to it. Forest regulations did not for a time seem as necessary in the U. States, with its great forest wealth, as in Europe. However, with the destructive methods of lumbering and the enormous waste by forest fires, the supply has been so encroached upon that means have been taken to repair the damage and to provide against its continuance. Various states have enacted laws designed to correct the former abuses by granting bounties for tree-planting and remission of taxes upon purely forest areas. The general government has also attempted to aid by laws providing for the acquirement of land upon the condition of planting a portion to trees. Since the laws enacted by the general government were improperly prepared, interpreted, and enforced, and have resulted in little good, they have been repealed. The greatest good has probably come from the reservation of extensive areas about the watersheds and sources of some great rivers. There are over 40 forest reserves in the U. States, embracing more than 46,000,000 acres.

FORESTERS, Ancient order of, a fraternal organization founded in 1745 and introduced into the U. States in 1832. The growth of the Order was slow until 1864. In 1902 the courts numbered approximately 9,000, with a total membership of nearly 1,000,000. The Order is one of the largest beneficiary societies in existence, with courts in 36 countries. Funds are raised by fixed dues, and more than $5,000,000 annually are distributed in benefits.

FORESTERS, Independent Order of, a fraternal and benevolent society founded at Newark, N. J., in 1874, and reorganized in 1881. The Order is general throughout the U. States and Canada. Its government is vested in a Supreme Court, with delegates from all the countries represented. High Courts, corresponding to the grand lodges of other societies, have supervision of the Order in various states and countries. The local bodies are called courts. The Order has a membership of 200,000, has paid more than $13,000,000 in benefits since its organization, and has a surplus fund of nearly $6,000,000.

FOREST MARBLE, in geology, an argillaceous laminated shelly limestone, alternating with clays and calcareous sandstones, and forming one of the upper portions of the Lower Oolite: so called from Whichwood Forest, in England, where the finer bands are quarried as marble.

FOR'FEITURE, a punishment annexed to some illegal act or remissness of an owner or tenant of property, whereby he loses his interest therein, together with his title, the same going to the party injured by such act or remissness.

FORGE, a workshop or other establishment in which iron or other metal is hammered and shaped by the aid of heat; also, the works where iron is rendered malleable by puddling and shingling. For military purposes a traveling forge is used by forces in the field.

FORGERY, at common law, the fraudulent making or alteration of a writing to the prejudice of another man's rights, or making, of any written instrument for the purpose of fraud and deceit; the word making, in this last definition, being considered as including every alteration of or addition to a true instrument.

FORGET-ME-NOT, the name of a common plant growing generally in damp or wet places. Scorpion-grass is also a name for it and others of its genus. It is a very beautiful plant, and considered to be the emblem of friendship in almost every part of the world. Its flowers are bright blue with a yellow eye. The dark-blue forget-me-not of the Azores is now cultivated in greenhouses, and is much esteemed for the brilliancy of its flowers.

FORLI', a town of North Italy, capital of a province of same name, 38 miles southeast of Bologna. Pop. 279,072.

FORLORN HOPE, a body of men, usually volunteers, selected from different regiments, to lead an assault, enter a breach, or perform other service attended with uncommon peril. The term is of Dutch origin; hope being from Dutch hoop, a company.

FORMATION, in geology, any series of rocks referred to a common origin or period, whether they consist of the same or different materials. Geological strata are divided into certain groups of one era of deposition, sometimes of very dissimilar mineralogical character, but inclosing the same fossil species; as, the Carboniferous, Oolitic, Cretaceous, Silurian, Laurentian, etc., formations. See Geology.

FORMIC ACID, an acid obtained from ants, when repeated quantities of them have been infused in boiling water. It is contained in human sweat and urine, in the common nettle and other plants, and may be prepared artificially in various ways. It is a colorless volatile liquid, with pungent odor, and producing intense irritation on the skin.

FORMO'SA, an island in the Chinese Sea, separated from the Chinese prov. of Fokien by a strait about 80 miles wide where narrowest. The island is about 250 miles in length and 70 in average breadth. It is divided by a central range of mountains (rising to 14,000 feet) into a western and eastern part, the former of which (mostly a plain) is occupied by large numbers of immigrant Chinese, and highly cultivated, producing in abundance corn, rice, sugar, pepper, camphor, oranges, bananas, etc. The eastern part is inhabited mainly by wild tribes of Malayan race, who are gradually disappearing before the Chinese. Northern Formosa is volcanic, and earthquakes occur. Several ports have been opened to European commerce, chiefly Tai-nan (the capital), Tam-sui, Ke-lung, and Takow; and the trade of the island since then has greatly increased. The chief exports are coal, tea, camphor, sugar, indigo, timber; the imports are cottons, woolens, opium, etc. Formosa now belongs to Japan. Pop. 3,000,000.

FOR'MULA, a fixed form of words or symbols. In theology it is a formal statement of doctrines; in mathematics, a general theorem, a rule or principle expressed in algebraic symbols. In chemistry it is a mode of expressing the constituents of a compound by means of symbols and letters. Thus water is represented by H_2O, in which H_2 stands for the two proportions of hydrogen and O for the one of oxygen which are combined to produce water.

FORNICATION, the illicit carnal intercourse by an unmarried person with one of the opposite sex, whether married or unmarried. In most countries this offense has been brought within the pale of positive law at some period of their history, and prohibited by the imposition of penalties more or less severe; but it is now usually left to the restraints which public opinion imposes on it in every community which is guided by the principles of morality and religion. In a few of the U. States the offense is made a misdemeanor by statute, punishable by fine and imprisonment, but in most of the states the common-law rule prevails.

FOR'REST, Edwin, American tragedian; was born in Philadelphia, in 1806. He made his first regular appearance in 1820 at the Walnut Street Theater, in Philadelphia, in Home's Douglas. In Shakespeare his best roles were Richard III., Coriolanus, Lear and Othello, but he was even more effective in Virginius, Spartacus and characters of that range, and in 1826, at the Park Theater, New York, made a decided triumph in Othello. Thenceforward his career was one of distinction, both in this country and in England, where he made his first appearance at Drury Lane in The Gladiator in 1836. His last professional ap-

pearance was in 1871. He died in December 12, 1872.

FORREST, Nathan Bedford, American soldier, was born near the site of Chapel Hill, Tenn., in 1821; he removed with his father in 1834 to Tippah County, Miss. Though at first opposed to a dissolution of the Union, he entered the confederate army as a private in June, 1861. In 1862, he was promoted to be brigadier-general, and thereafter served in Kentucky for some time under General Bragg. On January 24, 1865, he was placed in command of the cavalry in Alabama, Mississippi, and east Louisiana; on February 28th became a lieutenant-general; in March was defeated at Selma, Ala., by Gen. J. H. Wilson; and in May surrendered at Gainesville, his troops being included in the arrangement made by Gen. Richard Taylor with General Canby. He died in 1877.

FORT, a small fortified place surrounded with a ditch, rampart, and parapet, for the purpose of defending a pass, river, road, harbor, etc. Forts are made of different forms and extent according to the exigencies of the case. See Fortification.

FORT DODGE, the county seat of Webster county, Ia., situated on Des Moines river, the Chi., R. I. and Pac., Ill. Cent., Mason City and Fort D., and Minn. and St. Louis R. Rs.; 90 miles n. of Des Moines. It has fine quarries of building-stone, large deposits of gypsum, coal, fire-clay, potter's clay, and water-lime, and various manufactures. Pop. 14,519.

FORT MADISON, the county seat of Lee county, Ia., situated on Mississippi river, 23 miles below Burlington, and on the Atch., Top. and S. Fé, Burl. Route, and Ch., Fort Mad. and Des Moines R. Rs.; 237 miles s.w. of Chicago; connected with Illinois by one of the finest wagon and railway bridges on the river. Pop. 11,215.

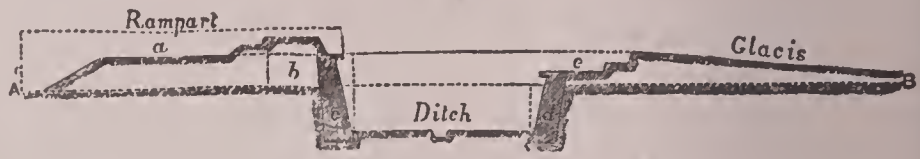
FORT SCOTT, the county seat of Bourbon county, Kan.; situated on the Marmaton river; 300 miles w. of St. Louis and 98 miles s. of Kansas City, Mo. Pop. 11,760.

FORT SMITH, one of the county seats of Sebastian county, Ark., situated at the confluence of Arkansas and Poteau rivers; 158 miles w. by n. of Little Rock. It has sawmills, planing-mills, furniture-factories, cotton compress and oil-seed mills, ice-factory, etc. Pop. 14,320.

FORTH, a river of Central Scotland, formed in Perthshire by the junction of two streams, the Duchray and the Dhu, about 1 mile w. of Aberfoyle. From Aberfoyle the river flows southeast, forming for a considerable part of its course the boundary between the counties of Stirling and Perth, winding in its lower course in a series of curves known as the Links of Forth, and expanding thereafter into the Firth of Forth, which forms the most important harbor of refuge n. of the Humber. Its chief ports are Leith, Granton, Bo'ness and Grangemouth. The Forth is navigable for the smaller class of vessels as far up as Alloa. Its length is about 170 miles. It is a good salmon stream. There are several islands in the estuary, on two of which, the Isle of May and Inchkeith, lighthouses are erected. The firth is crossed at Queen's ferry by a bridge.

FORTH AND CLYDE CANAL, a canal in Scotland constructed in 1768–90, and extending from the Forth at Grangemouth to the Clyde at Bowling, thus giving communication by water from the east to the west coast. It is 35 miles long. The Union Canal, 31½ miles long, joins it near Falkirk and connects it with Edinburgh.

FORTIFICATION, the science of strengthening positions in such a way that they may be defended by a body of men much inferior in number to those by whom they are attacked; and more particularly, the science of strengthening positions so as that they may be held against the assault of troops supported by artillery. Fortifications are usually divided into permanent and temporary. Permanent fortifications are works required to remain effective for any length of time, for the purpose of defending important positions and cities, dockyards, arsenals, etc. Temporary fortifications are such as are designed merely to throw temporary obstacles in the way of the enemy, as field-works, etc. The former are constructed on the principle that each part must be its fire support and be supported by some other part; that the works must protect the defenders from the enemy's fire as well as possible, and that the fire of the fortress must completely sweep all parts of the ground in front of the fortified lines. The more important details of a regular fortification may be briefly described as under: Around the place to be defended is raised a mound or bank of earth called a rampart, on the upper surface of which, the terre-pleine (a), the troops and cannon are placed. The terre-pleine is protected from the enemy's fire by a breastwork or parapet (b), about 8 feet high, sometimes pierced at certain intervals with embrasures through which the guns are fired. Beyond the rampart is the ditch, usually about 12 feet in depth, but varying greatly in width. The ditch is sometimes filled with water; in other cases it is dry. The scarp or escarp (c) is the inner wall of the ditch, and it is faced with masonwork or hurdles, sods, etc. (the revetment) to retain the earth of the rampart in its place. The counterscarp (d) is the opposite or outer wall of the ditch. From the top of the counterscarp outwards is a space about 30 feet wide (the covered-way, (e) protected by a parapet, the long superior outward slope of which towards the open ground forms the glacis. The use of the covered-way is to allow the troops to be drawn up on it unseen by the besiegers for the purpose of making a sortie; it also enables the defenders to keep up a closer fire on the attacking forces. The slope of the glacis is so constructed as to bring the assailants in the direct line of fire from the artillery on the ramparts. In the sectional cut a is toward the interior of the fort, b toward the open country. At certain intervals there are often bastions or projecting works at salient angles, commanding by their fire the curtain or straight portion of the fortified line between them. The use of the bastion has given the name to what is called the bastionary system of fortification, which has in modern times largely given way to what is known as the polygonal or German system, which is considered to have various advantages in relation to the powerful artillery of the present day. The polygonal system has also been called the caponier system, from the use of powerful casemated caponiers constructed across the ditches and serving instead of bastions for their defense. The general plan of the works is polygonal, with the ramparts placed on the sides of the polygon. The connecting line of fortifications surrounding a place is called the fortified enceinte, and the works in a regular fortress form a very complicated whole, including works to which such names as ravelins, demi-lunes, etc., are given. The fortified enceinte immediately surrounding a place is not now considered a sufficient defense, on account mainly of the long range of modern cannon. Hence it is usual to surround a fortress with a line of detached forts at some distance from the enceinte, or there may be more than one such line of advanced works. Fortifications intended to ward off attacks by sea have their sea-faces now commonly protected by plates of iron or steel. Scientific fortification may be said to commence with the great French engineer Vauban, who served under Louis XIV. He developed the bastioned system, which, as improved by Cormontaigne and others, is still the prevailing type of French fortification.



Section through line of fortifications.

Field Fortifications vary much according to the time allowed for construction, and during which they may prove useful. Among works of this nature are the redan, which consists of two parapets with a ditch in front, forming an angle facing the enemy; the lunette, which is a redan with short flanks; the redoubt, a closed work with a ditch and parapet all round. As none of those works has a flanking fire in itself, they have to be disposed so that they flank each other within rifle range. To do this effectually, and to strengthen the whole line, the plan generally adopted is to form an intrenched camp by a line of square redoubts, flanking each other, and also a line of simple redans in front of the intervals of the redoubts. When the time is not sufficient to throw up such works, simple forms of intrenchment, such as shelter trenches, are used to shelter troops or oppose the enemy's advance. A very shallow trench, with the earth thrown to the front, so as to afford shel-

ter to one man lying in it, may be made in somewhat less than half an hour; more elaborate forms in about one hour. So that by placing a man at every 4 feet, active troops can make good shelter for themselves in an hour. To impede the enemy's advance an abattis of felled trees may be used, also wire entanglements, chevaux-de-frise, etc.

FORTIS'SIMO (Ital.), in music, a direction to sing with the utmost strength or loudness.

FORTU'NA, the Roman goddess of success, corresponding to the Greek Tyche. She is generally delineated with a rudder, emblem of her guiding power; or later, with a bandage over her eyes and a scepter in her hand, and sitting or standing on a wheel or globe.

FORTUNA'TUS, the hero of an old popular legend. He obtained a wishing-cap and inexhaustible purse of gold, which finally ruined him and his sons. The first printed edition of the story appeared in Germany in 1509, but in various forms it has appeared in most of the languages of Europe.

FORT WAYNE, a flourishing city in Indiana, situated in a beautiful and well-cultivated country at the junction of the St. Mary's and St. Joseph's rivers, which here unite to form the Maumee. It has railroad and machine works, and derives its name from a fort erected here in 1794 by General Wayne. It is the seat of a Roman Catholic episcopal see. Pop. 1909 estimated 65,000.

FORT WORTH, an important railway center, the county seat of Tarrant co., Tex.; situated on Trinity river, 32 miles w. of Dallas and 210 miles n. of Austin. Among industrial establishments are grain elevators, flouring-mills, iron foundries, car-works, shops of the Fort Worth and Denver, the Texas and Pacific, and the Rio Grande Railways, large stock-yards, and one of the largest packing-houses in the Western U. States. Pop. 31,490.

FORUM, among the Romans, any open place where the markets and courts of justice were held. There were a number of such places in Rome, by far the most celebrated being the great Roman forum between Mount Palatine and the Capitoline Hill. This place, once adorned with the most beautiful statues and buildings, had become almost a waste known as the Campo Vaccino, or cattle-field, but of late years the government have made clearances and excavations, and taken charge of the valuable relics which are still left.—In legal phrase forum signifies the court or place where an action is instituted.

FOSS, or **FOSSE,** in fortification, a trench or ditch, often full of water, below the rampart of a fortified place, or a post that is to be defended. See Fortification.

FOSSIL, a term for the petrified forms of plants and animals which occur in the strata that compose the surface of our globe. Most of these fossil species, many of the genera, and some of the families, are extinct. When these remains are only partially fossilized, and occur in superficial or recent deposits, the term sub-fossil is employed. See Geology and Palæontology.

FOSTER, Birket, an English artist, born at North Shields in 1825. He learned wood-engraving under Landells, and in early life became a draughtsman. He soon achieved a high reputation as book illustrator, and illustrated the works of Goldsmith, Scott, Longfellow, Beattie, etc. His landscape drawings on wood are of great excellence. He afterwards devoted himself to water-color painting, in which his reproductions of rustic life were very successful. He died in 1899.

FOSTER, Charles, American politician and secretary of the treasury. He was born in 1828 near Tiffin, Ohio. During the Civil War he actively aided in the recruiting and equipment of the Ohio troops. It was not until 1870 that he entered political life. In that year he was nominated by the republicans of his district for congress, and was elected. He was reëlected in 1872, 1874, and 1876. In 1879 he was nominated for governor of Ohio, and in 1881, was re-elected, serving until January 1, 1884. In 1889 Foster was appointed by President Harrison chairman of a commission to draw up a treaty with the Sioux Indians. In February, 1891, he succeeded William Windom as secretary of the treasury in Harrison's cabinet. He died in 1904.

FOSTER, John Watson, American diplomat, born in Pike co., Ind., in 1836. At the beginning of the Civil War he entered the Union service as a major of volunteers, and after attaining the rank of colonel headed a brigade in General Burnside's expedition to East Tennessee and was the first to occupy Knoxville (1863). During the Bering Sea controversy he acted as agent of the United States before the arbitration tribunal. He succeeded to the secretaryship of state (1892–93). Later he was legal adviser to the Chinese plenipotentiaries in their peace negotiations with Japan (1895); again represented the United States in the Bering Sea question (1897); and in 1898 was a member of the Anglo-American joint high commission to settle the disputes between Canada and the United States.

FOSTER, Stephen Collins, American song composer, born in 1836 at Lawrenceville, near Pittsburg, Pa. Many of his songs, the first of which, "Open Thy Lattice, Love," was published in 1842, have become so popular that they may be regarded as veritable folk-songs; "Louisiana Belle," "Old Uncle Ned," "My Old Kentucky Home," "Massa's in the Cold, Cold Ground," "Ellen Boyne," "Old Folks at Home" ("Down on the Suwanee River"), "Come Where My Love Lies Dreaming," are some of the most popular of Foster's 175 published songs. He died in New York in 1864.

FOUCHE (fö-shā), Joseph, Duke of Otranto, a minister of Napoleon I., was born in 1763. On the fall of Robespierre (1794), Fouché, who had for some time tended towards the moderate party, managed to make friends with Barras, and was rewarded for his betrayal by the ambassadorship to Milan. He was minister of police at Napoleon's final abdication and played an important part in the arrangements. He remained in office under Louis XVIII. for a time, but the dislike of the royalist party at length forced him to resign (1815). He went as ambassador to Dresden, but afterward retired to Prague, and latterly to Tricste, where he died Dec. 25, 1820.

FOUNDATION, that part of a building which is under ground, or the portion of the ground on which walls, piers, etc., rest. Foundations are usually made by providing a hard impermeable base for the masonry by methods which vary according to the position and soil. Where there is rock below nothing more is needed than a dressing for the surface. Submerged foundations such as those for breakwaters, bridges, etc., form special cases for engineering.

FOUNDATION, a donation or legacy, in money or lands, for the maintenance or support of some useful charitable institution, as an hospital, a college, a school, etc.

FOUNDLING HOSPITALS, institutions for receiving children abandoned by their parents and found by strangers. Among such institutions are that of Paris, instituted in 1670, and that of London in 1739. The latter was originally a hospital for all exposed children; but the enormous increase in abandonments caused the hospital to be changed in 1760 to one for poor illegitimate children whose mothers are known.

FOUNT, or **FONT,** among printers, etc., a quantity of types, in proportions sorted for use, that includes ordinary letters, large and small capitals, single letters, double letters, points, commas, lines, numerals, etc.; as a fount of Pica, Bourgeois, etc.

FOUNTAIN, or **ARTIFICIAL FOUNTAIN,** a contrivance by which water is made to spout from an artificial channel, and often to rise up to a great height in a jet or jets. Rome, in particular, is noted for its fountains. At Paris, also, the fountains of the Place de la Concorde, the Tuileries, and at Versailles, are splendid structures.

FOURIER (fö-ri-ā), François Marie Charles, a French socialist and founder of the system named after him, was born in 1772 at Besancon. He died Oct 10, 1837. In his social system Fourier holds that the operations of industry should be carried on by Phalansteries, or associations of 1800 members combining their labor on a district of about a square league in extent, under the control of governors elected by each community. In the distribution a certain minimum is first assigned for the subsistence of every member of the society, whether capable or not of labor. The remainder of the produce is shared in certain proportions to be previously determined among the three elements, labor, capital, and talent. The capital of the community may be owned in unequal shares by different members, who would in that case receive, as in any other joint-stock concern, proportional dividends. The claim of each person on the share of the produce apportioned to talent is estimated by the grade which the individual occupies in the several groups of laborers to which he or she belongs, these grades being in every case conferred by the voice of his or her companions. The remuneration received would not of necessity be expended in common. Separate

rooms or sets of rooms would be set aside for those who applied for them, no other system of living together being contemplated than such as would effect a saving of labor in building and the processes of domestic life, and reducing the enormous portion of the produce of industry at present carried off by middlemen and distributing traders to the narrowest possible margin.

FOURTH, in music, a distance comprising three diatonic intervals, or two tones and a half. Three full tones compose a tritone or fourth redundant. The diminished fourth consists of a whole tone and two semi-tones.

FOWL, a word originally synonymous with bird, now used in a stricter sense to designate the common domestic fowl. The general form and characters of the bill, etc., agree with those of the pheasants, but the crown of the head is generally naked and furnished with a fleshy comb, the base of the lower mandibles also bearing fleshy lobes or wattles —characters which are most conspicuous in the males. The legs of the male are furnished with spurs which are much used in conflict, the cocks being very pugnacious and unable to suffer the presence of a rival. In the center of the cock's tail are two long feathers, which fall backward in a graceful arch and add great beauty to the whole aspect of the fowl. Except in the pure white breed the plumage of the cock is always more splendid than that of the hen. Among well-known varieties are the Cochin-China Fowl, the Game Fowl, the Darking, the Spanish Fowl, and the Bantam.

FOWLER, Orson Squire, American phrenologist, was born in Coshocton, N.Y. in 1809. After graduating he settled in New York, where he began writing and lecturing on phrenology. In 1836 he published his first book, Phrenology Proved, Illustrated, and Applied, and in 1838 founded the American Phrenological Journal. He was the founder of practical phrenology in the United States. Among his numerous published works are: Memory and Intellectual Improvement; Matrimony, or Phrenology Applied to the Selection of Companions; Love and Parentage; The Self-Instructor in Phrenology and Physiology; Sexual Science. He died in 1887.

FOX, an animal closely allied to the dog, with a straight bushy tail, elongated pupils, and erect ears. Foxes are natives

Red fox.

of almost every quarter of the globe, and are everywhere among the most sagacious and wily of all beasts of prey, very voracious, devouring birds and small quadrupeds, and committing ravages not only on animals, but on fruits, honey, eggs, etc. The common fox of America is well known. Among other species there are the Arctic fox celebrated for its glossy white winter fur; the black fox, similar to the common fox, but distinguishable by its rich, shining black fur, a native of the northern parts of Asia and America; the gray fox has a thick tail containing at its tip a tuft of stiff hairs, common through the northern parts of America; the red fox of America, generally of a pale-yellow hue; the crossed fox, fur a sort of gray, muzzle and lower parts of body black, a dark cross on the shoulders; the swift fox, an inhabitant of the plains which lie at the base of the Rocky Mountains.

FOX, Charles James, an eminent English statesman, born January 24, 1749, the second son of Henry, first Lord Holland. His father procured him a seat for the borough of Midhurst in 1768, before he was of legal age, and in 1770 he was appointed one of the lords of the admiralty, which situation he resigned in 1772, and was appointed a commissioner of the treasury. After being a supporter of the administration for six years, a quarrel with Lord North threw Fox into the ranks of the whig opposition, where along with Burke and others, he steadily assailed the government, especially on the score of their American policy. In 1780 he was elected member for Westminster, and on the defeat of the administration of Lord North, and the accession of that of the Marquis of Rockingham, he obtained the office of secretary of state for foreign affairs (1782). But the death of the Marquis of Rockingham suddenly divided the party; and when the Earl of Shelburne became first lord of the treasury Fox retired. Soon after a union took place between his friends and those of Lord North, known as the coalition ministry, which was overthrown by Fox's famous East India Bill (1783). He welcomed the breaking out of the French revolution, and his views on this subject led to a memorable break between him and his old friend Burke. Fox firmly opposed the principle on which the war against France was begun, and strenuously argued for peace on every occasion; but eventually, on becoming secretary for foreign affairs in 1806, acquiesced in its propriety. His

Charles James Fox.

health, which had been impaired by his loose manner of living, now began rapidly to decline, and he died the same year a few months after the death of Pitt, his great rival, in 1806.

FOX, George, the founder of the Society of Friends, or Quakers, was born at Drayton, in Leicestershire, in 1624. He was educated religiously, and at the age of nineteen pursuaded himself that he had received a divine command to forsake everything else and devote himself wholly to religion. In 1648 he commenced to preach publicly at Manchester, about which time he also adopted the peculiar language and manners of Quakerism. At Derby his followers were first denominated Quakers, in consequence of their trembling mode of delivery, and calls on the magistracy to tremble before the Lord. In 1655 he was sent a prisoner to Cromwell, who, having ascertained the pacific tendency of his doctrines, had him set at liberty. In 1666 he set about forming the people who had followed his doctrines into a formal and united society. In 1669 he married the widow of Judge Fell, and soon after went to America, where he remained two years, which he employed in making proselytes. On his return he was thrown into Worcester jail, but was quickly released, and went to Holland. In 1684 he again visited the continent. He died in 1691, the Society of Friends having by that time acquired considerable importance. The writings of Fox have been collected into three volumes.

FOX, George L., American comedian, born in Boston in 1825. Inspired by the famous Ravel Brothers to undertake pantomime, he created a distinct place for that kind of entertainment in New York City, first at the National Theater and later at the New Bowery, of which he was for a time lessee and manager. His principal rôle was that of the clown in Humpty Dumpty, and no one has ever equaled him in this character, which he may be said to have created. He was scarcely less distinguished in his burlesques on the famous tragedians of the day, and his resemblance to Booth in the character of Hamlet was remarkable. He died in 1877.

FOX-BATS, or **FLYING-FOXES,** a name given to the fruit-eating bats including some of the largest of the bat tribe, one species, or kalong, attaining a length of from 4 to 5 feet from the tip of one wing to the tip of the other. They inhabit Australia, Java, Sumatra, Borneo, etc., as well as the continents of Asia and Africa.

FOXE, John, an English church historian, born in 1517. He studied at Oxford, and was elected a fellow of Magdalen in 1543, from which he was expelled two years later on a charge of heresy. In the reign of Edward VI. he was restored to his fellowship, but during Mary's reign again went abroad, to Basel. On the accession of Elizabeth he returned to his native country, and was received in the most friendly manner by his former pupil, the Duke of Norfolk, who settled a pension on him. Secretary Cecil also obtained for him a prebend in the church of Salisbury; and he might have received much higher preferment if he would have subscribed to the

articles enforced by the ecclesiastical commissioners. He died in 1587. His principal work is the History of the Acts and Monuments of the Church, commonly called Foxe's Book of Martyrs, first printed in 1563, in one vol. folio.

FOX'GLOVE, a common plant growing on banks, pastures, etc., in hilly and especially subalpine and rocky countries in Europe. Its flowers are campanulate, and somewhat resembling the finger of a glove. It is one of the most stately and beautiful of the herbaceous plants, and one that has great reputation as a medicinal plant, being employed as a sedative, narcotic, and diuretic in diseases of the heart and in dropsy. Its medicinal properties are due to the poisonous substance known as digitalin. A decoction or infusion of the leaves is what is generally used.

FOXHOUND, a hound for chasing foxes, a variety of hound in which are combined, in the highest degree of excellence, fleetness, strength, spirit, fine scent, perseverance, and subordination. The foxhound is smaller than the staghound, its average height being from 20 to 22 inches. It is supposed to be a mixed breed between the staghound or the bloodhound and the greyhound. It is commonly of a white color with patches of black and tan.

FOX INDIANS, a tribe of N. American Indians, belonging to the Algonquin family, now few in numbers and scattered over the Indian territories, Iowa, Kansas, and Nebraska.

FOXTAIL-GRASS, the common name given to certain grasses because of the close cylindrical panicle in which the spikelets of flowers are arranged, having somewhat the shape of a fox's tail.

FOY (fwâ), Maximilian Sebastian, a French general, born in 1775. In 1812, after the defeat of the French at Salamanca, he succeeded Marmont as commander-in-chief, and showed much talent in his conduct of the operations on the Douro. He was present in all the battles of the Pyrenees, until he was dangerously wounded at Orthez in 1814. In 1815 he commanded a division at Waterloo, where he was wounded for the fifteenth time. In 1819 he was appointed division-inspector of infantry, and the same year was elected deputy by the department of the Aisne. He at once distinguished himself as one of the leading orators of the liberal party and became very popular. He died at Paris, Nov. 28, 1825.

FRA, an Italian prefix, derived from the word frate, brother, and used before the names of monks; for instance, Fra Giovanni, brother John.

FRACTION, in arithmetic and algebra a combination of numbers representing one or more parts of a unit or integer; thus, four-fifths $\frac{4}{5}$ is a fraction formed by dividing a unit into five equal parts, and taking one part four times. Fractions are divided into vulgar and decimal. Vulgar fractions are expressed by two numbers, one above another, with a line between them. The lower, the denominator, indicates into how many equal parts the unit is divided; and the number above the line, called the numerator, indicates how many of such parts are taken. A proper fraction is one whose numerator is less than its denominator. An improper fraction is one whose numerator is not less than its denominator, as $\frac{8}{8}$, $\frac{5}{2}$. A simple fraction expresses one or more of the equal parts into which the unit is divided, without reference to any other fraction. A compound fraction expresses one or more of the equal parts into which another fraction or a mixed number is divided. Compound fractions have the word of interposed between the simple fractions of which they are composed: thus, $\frac{1}{3}$ of $\frac{4}{5}$ of $1\frac{1}{4}$ is a compound fraction. A complex fraction is that which has a fraction either in its numerator or denominator, or in each of them: thus, $\frac{5\frac{1}{2}}{9}$, $\frac{8}{9\frac{1}{3}}$, and $\frac{5\frac{1}{2}}{6\frac{2}{3}}$ are complex fractions. In decimal fractions the denominator is 10, or some number produced by the continued multiplication of 10 as a factor, such as 100, 1000, etc.; hence, there is no necessity for writing the denominator, and the fraction is usually expressed by putting a point (·) before the numerator, as $\cdot 5 = \frac{5}{10}$; $\cdot 25 = \frac{25}{100}$; $\cdot 05 = \frac{5}{100}$. The expression $542\cdot461$ would thus be equivalent to $542\frac{461}{1000}$. All calculations are much simplified in decimal fractions; yet, simple as the system is, it was discovered first in the 15th century by the German mathematician Regiomontanus.

FRACTURE, in mineralogy, is the manner in which a mineral breaks, and by which its texture is displayed; thus, an even fracture shows a level face or plane of some extent; uneven, when the surface is rough and broken; conchoidal, when one side is convex and the other concave, as in a molluscous shell; fibrous, when the separated edges have the appearance of torn filaments; hackly when there are many fine sharp points or inequalities.

FRACTURE, in surgery, is the breaking of a bone. It is simple when the bone is only divided; compound when there is also a wound of the soft parts leading down to the fracture. A fracture is termed transverse, longitudinal, or oblique according to its direction in regard to the axis of the bone. It is called complicated if accompanied with dislocation, severe contusions, wounded blood-vessels, or any disease which prevents the union of the bones and causes them to be very easily broken. A comminuted fracture is one in which the bone is broken into several small pieces at the point of rupture. An incomplete fracture is one in which only a portion of the fibers is broken. A stellate fracture is a series of fractures radiating from a center. When a fracture takes place there is a pouring out of fluid—lymph—and cells from the blood contained in the vessels of the lining membrane of the bone as well as from the vessels of the soft parts which have also suffered injury. This material surrounds the broken ends of the bone, becomes firm and consolidated, and in about three weeks is hard enough to keep the broken ends in position. A formation of bone then takes place round the seat of fracture. This is called "provisional callus," because, when the process of repair is completed and true bone has formed to unite the break, it is re-absorbed and gradually disappears. Meanwhile a process of repair goes on between the broken ends, uniting them by the formation of true bone or "definite callus." The more quickly and accurately after the break the broken ends are brought together, the more rapid will be the reunion. The treatment of a simple fractured bone is to bring the portions into their natural position and to keep them permanently thus, by splints of some kind, pasteboard splints, for instance, dipped in warm water, with wooden ones exterior to them; or a mass of plaster of Paris may be used for the same purpose.

FRA DIAV'OLO, a celebrated Neapolitan brigand, whose real name was Michele Pezza.

FRANC, a modern French silver coin, but the name was given to two ancient coins in France, one of gold and the other of silver. The value of the gold franc was about $2.75. The silver franc was in value a third of the gold one. The name was given from the device Francorum Rex, king of the French, on the coin when first struck by King John in 1360. The modern French franc is a silver coin and money of account which since 1795 has formed the unit of the French monetary system, and has also been adopted as the unit of currency by Switzerland and Belgium. It is of the value of a little over 19 cents, and is divided into 100 centimes.

FRANCE (anciently Gallia), a maritime country in the west of Europe, forming one of its most extensive, most populous, and most influential states. It is situated between lat. 42° 20′ and 51° 5′ n.; and lon. 4° 50′ w. and 7° 40′ e., and is bounded n. by the Straits of Dover and the English Channel; w. by the Atlantic (Bay of Biscay); s. by Spain and the Mediterranean Sea; e. and n.e. by Italy, Switzerland, Germany, and Belgium. Its greatest length from north to south is 600 miles, and its greatest breadth 547 miles. The coast-line on the whole is considerably diversified by bays, estuaries, and indentations of various kinds, and presents numerous good harbors and roadsteads. It is studded by a number of islands, especially in the northwest and west, the largest being Oléron, Ré, and Belle Isle. The total area (including Corsica) is 204,092 sq. miles. The capital is Paris; the other large towns in order of population are Lyons, Marseilles, Bordeaux, Lille, Toulouse, Nantes, St. Etienne, Havre. The interior is traversed from southwest to northeast by successive chains of mountains, commencing with the Pyrenees and including the Cevenness, the Côte d'Or, the Vosges, and others, forming the water-shed, on one side of which the rivers flow west and north into the Atlantic and the English Channel, on the other side east and south into the Mediterranean. At its northeastern extremity this system is met by the Alps and the Jura. A considerable portion of the Western Alps belongs to southeastern France. Mt. Blanc itself (15,781 feet) is mostly within the French boundary-line.

The four great rivers of France are the Loire, Seine, Rhone, and Garonne. France has in all more than 200 navigable streams, with a total navigation of

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about 6000 miles. Lakes are few, and individually very limited in extent.

About nine-tenths of the soil of France is productive, and about one-half of the whole is under the plough. The cereals forming the great bulk of the cultivated crops are wheat, oats, rye, and barley. The crops next in importance to these are potatoes, hemp, rape, corn, buckwheat, flax, and beet. Beet is cultivated extensively in some departments, especially in that of Nord, for the manufacture of sugar. The cultivation of tobacco is monopolized by the government, and is confined to certain departments. The rearing of sheep is successful, much of the wool being scarcely inferior to merino wool. Excellent horses are bred in the north. Asses and mules, generally of a superior description, are much employed. The cultivation of the vine is one of the most important branches of French agriculture, the total quantity of land in vineyards being nearly a twenty-fifth of the whole surface. In everything relating to this branch of culture the French are unsurpassed, the various first-class wines which they produce under the names of Champagne, Burgundy, Bordeaux, etc., being universally known. It is estimated that in good years France produces about one-half of the whole wine production of the world. The forests occupy about one-seventh of the whole territory.

Coal-fields are numerous, but only two are really of importance—that of Valenciennes in the northeast, forming the western extremity of the great Belgian coal-field and that of St. Etienne in the southeast, to which the manufactures of that town, Lyons, and the surrounding districts, are indebted for much of their prosperity. The annual output falls so far short of the annual consumption that a large import takes place from England and Belgium, particularly the latter, and wood continues to be the common fuel throughout France, at least for domestic purposes. The coal-fields contain seams of iron, which are extensively worked, and furnish ore to a great number of blast-furnaces; but of the total amount of ore smelted in the country a considerable proportion is imported. Other metals, such as lead, zinc, manganese, copper, etc., are obtained to some extent.

The most important of the textile manufactures is that of silk goods, having its chief seat at Lyons and the surrounding districts. It employs about two millions of persons, and furnishes about 27 per cent in value of the whole of the manufactured products of France. After silk goods, though at a considerable distance, follow cotton stuffs and woolens, made largely at Rheims, Amiens, and Beauvais; carpets at Abbeville; tapestry at Paris and Beauvais; linens, including fine muslin, gauze, and lace at St. Quentin, etc. The fisheries of France are important. Among the principal is that of sardines on the coast of the Bay of Biscay; that of herring, mackerel, turbot, salmon, etc., in the English Channel and the North Sea; that of tunnies and anchovies on the coasts of the Mediterranean. Oyster-breeding is largely engaged in, the most extensive oyster-beds being those of the basin of Arcachon in the department of the Gironde. Cod-fishing is carried on actively near the Newfoundland banks by French fishermen, and also near Iceland.

The principal towns from which the internal commerce emanates are Paris, Lyons, Rouen, Lille, St. Etienne, Toulouse, Nîmes, Nancy, Perpignan, etc. The shipping of France is much below what might be expected from the development of its foreign commerce, considerably more than one-half of which is carried by foreign vessels. The chief seaports are Marseilles, Havre, Bordeaux, Rouen, Nantes (including St. Nazaire), Dunkirk, Calais, Boulogne, Dieppe.

France possesses about 3000 miles of canals in addition to about 6000 miles of navigable rivers, giving a total equal to about 1 mile of internal navigation for every 25 sq. miles of surface. The railways in France partly belong to the state, and partly have been granted to private companies for a limited period, at the end of which they become state property.

In France the superintendence of education in all its branches is expressly committed to a high functionary, who takes the name of minister of public instruction and fine arts and is assisted by an educational council. For a good part of last century France had only one university, the University of France, embracing a series of "faculties" (facultés), which were a sort of university colleges, each specially devoted to literature, law, medicine, theology, etc. Since 1896 a number of local universities have been formed from these institutions, and university education is now in a flourishing state. Paris has again a university of her own, besides the Collège de France Ecole Polytechniqne, Ecole Normale Supérieure, etc. Secondary instruction, either classical or commercial and industrial, is given by the state in the lyceums, by the communes in the communal colleges, or in certain other seminaries. There are about 90 lyceums, generally situated in the capitals of the departments, and over 250 colleges. Primary instruction is given in the communal schools, being compulsory and free. Religion, in like manner, is taken under the cognizance of the state, and falls within the province of the minister of justice and religion. The state declares that the Roman Catholic is the religion of the majority, but does not establish it; on the contrary, it places all forms of religion which have more than 100,000 adherents, and are not obviously subversive of social order, on an equal footing, and professes to deal impartially with all by paying salaries to their ministers. The Protestants are less than 2 per cent of the whole population.

By law military service is declared to be obligatory upon every Frenchman who is not pronounced unfit for military service. They have to serve first in the army (armée active) for three years, then in the reserve of the regular army for ten years, next in the territorial army for six years, and finally in the reserve of the territorial army for six years. This gives France on a peace footing an army of more than half a million, which on a war footing may be brought up to two and a half millions or even more. The French navy is manned partly by conscription and partly by voluntary enrollment. In 1906 the effective war navy of France included 47 heavy fighting vessels, of which, however, some, though launched, were not completed; 13 more were for coast service, besides other iron-clads still on the stocks.

France has now a larger revenue, expenditure and public debt than any other country in the world. The estimate gross revenue for 1900 was fully $710,000,000, the expenditure being estimated at somewhat less. The consolidated debts amount to about $4,400,000,000, while the total national debt is at least about $6,000,000,000. The chief items of revenue are excise and customs, registration, stamps, posts and telegraphs, and other state monopolies, land tax, licenses, etc.

France has been a republic since the overthrow of the second empire on the 4th of September, 1870. The details of the constitution were fixed by a law passed by a national assembly which met in 1871 (some revision having been made since). This law places the legislative authority in the hands of an assembly composed of two chambers, the chamber of deputies and the senate. The chamber of deputies is elected by universal suffrage, each arrondissement forming an electoral district and a member being elected for every 70,000 inhabitants. The deputies are elected for four years. The senate consists of 300 members, of whom 75 were originally elected for life; but in 1884 it was enacted that vacancies among the life senatorships should be filled up as they arose by the election of ordinary nine-year senators. Both senators and deputies are paid. The head of the government is a president, elected for seven years by a majority of votes of the members of the two chambers sitting as one. The president is assisted by a body of ministers appointed by him. He has the appointment to all civil and military posts. The total French dominions are as follows:

	Area in Sq. Miles.	Population.
France	207,054	39,118,995
Colonies	4,089,076	53,412,340
	4,296,130	92,531,335

France or Gaul, at the earliest period of which anything is known with regard to it, was inhabited by a number of independent tribes, who appear to have been mainly Celtic in race. In the latter half of the 2d century B.C. the Romans conquered a portion of the southeast, and under Julius Cæsar the conquest of all Gaul was completed between 58 and 51 B.C. In the decline of the Roman empire German tribes began to make settlements in Gaul, and it was from a body of these known as Franks, that the name France arose. Toward the end of the 5th century Clovis, chief of the Salian Franks, made himself master not only of almost all France, but also of a considerable territory east of the Rhine. The dynasty which he founded was called the Merovingian from his grandfather Merovæus. Clovis died in 511, leaving his kingdom to be divided among his four sons as subsequent rulers

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English Miles
0 10 20 40 60 70
Rail Roads.....

DEPARTMENT OF THE SEINE ON ENLARGED SCALE
Fortifications shown thus ~~~ Forts • Railways

Longitude West 2 from Greenwich
Longitude East 2 from Greenwich

FRANCE

often did. It was reunited under Charlemagne who became sole ruler, and conquered and organized an empire which extended from the Atlantic on the west to the Elbe, the Saale, and the Bohemian mountains on the east, and embraced also three-fourths of Italy, and Spain as far as the Ebro. By Pope Leo III. on Christmas-day in the year 800 he was crowned in the name of the Roman people as Emperor of the West. There was as yet, strictly speaking, no kingdom of France, and Charlemagne was a German, and his empire a German one.

To Charlemagne succeeded in 814 his youngest son Louis the Pious. At the death of the latter the empire, after many disputes, was eventually divided by the Treaty of Verdun in 843 among his sons, the portion nearly corresponding to modern France falling to Charles the Bald. From this time the separate history of France properly begins, the history of the French language being also traced to the same period, while the eastern portion of the old Frankish territory remained German. The growth of French nationality began when upon the extinction of the descendants of Charlemagne, Hugh Capet, Duke of France, who had held the real power under three weak kings, mounted the throne himself, and thus became the founder of the Capetian dynasty. The Capets made Paris the center of the new monarchy.

The first task of the Capetian line was to reconquer the royal prerogatives from the great vassals, but for two centuries without much success until the growth of the towns ultimately became the allies of the kings, as a powerful check on the nobles.

Early in the 13th century the stability of the French throne was endangered by the influence acquired in France by Henry II. of England, who possessed, either by inheritance or by his marriage with Eleanor of Aquitaine, the whole of the west of France except Brittany. Louis was succeeded by his son Philip Augustus (Philip II.), who did much to strengthen the throne, depriving John, king of England, of Normandy, Maine, and Anjou. Under the wise rule of Louis IX. (St. Louis), and his successors, the influence of the crown went on increasing until the outbreak of the wars with England.

The first branch of the Capetian line of kings became extinct on the death of Charles IV., the last of the sons of Philip the Fair, the Salic law excluding the female succession. The crown thus fell to Philip of Valois, a cousin, who became king as Philip VI. His claim was disputed by Edward III. of England, and the dispute led to a series of wars which were not terminated for more than 120 years. During this period France was reduced to a state of great misery. Edward compelled the surrender to England of some of the finest provinces of France while the country was plundered by banditti, and the Jacquerie, a mass of furious peasants (about 1358), satiated their spirit of vengeance in the blood of the nobility. Charles (V.) the Wise, who succeeded John the Good in 1364, and his constable, Du Guesclin, were able to restore order only for a short time, although during this reign the English were driven out of most of their possessions in France. Then came the long and unhappy reign of the imbecile Charles VI. (1380–1422), during which Henry V. of England, reviving the claim of Edward III. to the French crown, invaded France, won the field of Agincourt, and obtained a treaty (Treaty of Troyes), acknowledged the right of succession to the French crown in himself and his descendants. Charles VI. died in 1422, a few weeks after Henry V., whose son, Henry VI., a minor, was acknowledged as king by the greater part of France. But between 1429 and 1431 the peasant girl Joan of Arc animated the French in the cause of the dauphin, who was crowned as Charles VII. at Rheims in 1429, and in 1451 the English had lost all their possessions in France, except Calais, which remained English until 1558. The shrewdness and perfidy of Louis XI. (1461–83) completed the subjugation of the great barons, and laid the foundation of absolute monarchy.

During the next hundred years five wars were fought with Germany in efforts to obtain territory.

The foundation of the national debt, the weight of which broke down the throne 250 years later, was laid in this period. Intrigue and corruption gave to women a dangerous influence at court and in public affairs. Under the administration of Charles IX. (conducted during his minority by the queen-mother, Catherine de' Medici) France was inundated with the blood of Frenchmen, shed in the religious wars from 1562. (See Bartholomew's Day.) When Henry IV. went over to the Catholic Church (1593), having hitherto been the leader of the Huguenots.

Henry IV. was the first French sovereign of the house of Bourbon, which inherited its right to the throne from a son of Louis IX. He united to the crown of France the Kingdom of Navarre, which he had inherited from his mother, Jeanne d' Albret. In his government of France Henry showed all the qualities of a great prince and a great statesman, establishing religious toleration (Edict of Nantes, 1598), and laboring diligently for the welfare of the state. He was cut off prematurely by the dagger of the fanatic Ravaillac (1610). During the minority of Henry's son Louis XIII. the French policy was at first wavering, until the prime-minister, Cardinal Richelieu, gave it a steady direction. He restored the French influence in Italy and the Netherlands, humbled Austria and Spain, and created that domestic government which rendered the government completely absolute.

Louis XIII. died in 1643, the year after his great minister, and was succeeded by Louis XIV., "le Grand Monarque." The policy of Richelieu was carried on by Mazarin during the regency of Anne of Austria, while Louis was still a minor, and also for some years after Louis was declared of age. During his ministry France obtained by the Peace of Westphalia (1648) the German province of Alsace, and by the Peace of the Pyrenees (1659) parts of Flanders, Hainault, Luxembourg, etc. After the death of Mazarin, in 1661, Louis XIV. took the government into his own hands, and ruled with an absolute sway. The period which immediately followed was the most brilliant in French history. His ministers, especially Colbert, and his generals, Turenne, Condé, Luxembourg, and the military engineer Vauban, were alike the greatest of their time; the writers of the period were also among the greatest in French literature. But Louis XIV.'s love of costly display upon which his reputation was built involved France in hopeless debt. Louis XV., the grandson of Louis XIV., succeeded in 1715 at the age of five years. During his minority the regent, the Duke of Orleans squandered the revenues in the most reckless manner, and matters went from bad to worse. In 1723 Louis was declared of age, but he sank under the pernicious influences of mistresses like Pompadour and DuBarry into extravagance and license, entering into useless and costly wars and contracting enormous debts. During this reign two important acquisitions were made by France, namely, Lorraine and Corsica.

With the reign of Louis XVI. began the period of expiation for the misdeeds of the French monarchy and aristocracy, which had culminated in the preceding reign. The king himself was amiable, but the whole administration was rotten, and the court, the nobility, and the clergy formed only one privileged class united to oppress the people. The good intentions of Louis were neutralized by a total lack of energy and firmness. The first difficulty of his government, and the rock on which it split, was the hopeless condition of the public finances, with which Turgot, Necker, Calonne, Brienne, and again Necker tried in vain successively to grapple. Finding all ordinary measures unavailing, Necker demanded the convocation of the states general which had not met since 1614. They met on 5th May, 1789, but as the nobles and clergy refused to conduct business so as to give the third estate its due weight, the deputies of this body assumed the title of the national constituent assembly, and resolved not to separate till they had given a constitution to France. The clergy and nobles then yielded, and the fusion of the three orders was effected on 27th June. Foreign troops, however, were brought to Paris to overawe the assembly. The people now demanded arms, which the municipality of Paris supplied; and on 14th July the bastille was captured and destroyed. Lafayette was made commander of the newly-established national guard. On the 4th August a decisive step was taken by the abolition of all feudal rights and privileges. On 5th October Versailles was attacked by the mob, and the royal family, virtually prisoners, were taken to Paris by Lafayette. The king tried to obtain the aid of some of the foreign powers against his subjects, and made his escape from Paris (20th June, 1791); but he was recognized, arrested at Varennes, and brought back to Paris. On 30th September, 1791, the assembly brought its work to a finish by producing a new constitution, which was sworn to by the king on 14th September, and he was then reinstated in his func-

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tions. This constitution deprived the king of arbitrary powers, provided liberty of worship and freedom of the press, of commerce, of industry; abolished the laws of primogeniture and entail as well as titles.

The constitutionalists and monarchists invoked the aid of the Emperor of Germany and the King of Prussia, on behalf of the king, and on 20th April 1792, the assembly declared war against Austria and Prussia. Reverses to the French troops caused a popular rising, and the Tuileries, after a sanguinary combat, were taken and sacked. The king took refuge with his family in the assembly, which was invaded and compelled to submit to the dictation of the victors by assenting to the suspension of the king and the convocation of a national convention in place of the assembly. The first act of the convention was to proclaim a republic. On 3d December the King was cited to appear before it. On 20th January, 1793, he was sentenced to death within twenty-four hours, and on the 21st the sentence was executed. This violent inauguration of the republic shocked public opinion throughout Europe, and armed the neutral states against France. England, Holland, and Spain joined the coalition. The extremists in France only grew more violent, a committee of public safety, with sovereign authority, was appointed 6th April, and the reign of terror begun. Christianity was formally abolished. Risings against the government were put down with frightful bloodshed. Both in Paris and the provinces executions and massacres of persons alleged to be disaffected to the party in power followed each other daily. The queen was executed on 16th October, 1793, the Girondists on 31st October, and others followed, Robespierre being foremost in the bloody work. At length the reign of terror came to an end by the execution of Robespierre and his associates on 27th and 28th July, 1794. Danton and Hébert, his old allies, he had already brought to the scaffold. Marat, another man of blood, had perished by assassination. The campaigns of 1793 and 1794 resulted favorably to the French arms, which were carried beyond the French frontier, Belgium and Holland being occupied, Spain being invaded, and the allies being driven across the Rhine. These successes induced Prussia and Spain to sign the treaties of Basel (1795), recognizing the French republic. In 1795 the convention gave the republic a new constitution, a chamber of five hundred to propose the laws, a chamber of ancients to approve them, an executive of five members, one elected annually, called the directory. The convention was dissolved on 26th October.

Napoleon Bonaparte now began to be the most prominent figure in French affairs; and after his brilliant successes against the Austrians both north and south of the Alps, and his empty conquest of Egypt, it was not difficult for him to overthrow the government of the directory. This was accomplished in the revolution 18th and 19th Brumaire (9th 10th Nov. 1799), the directory being succeeded by the consulate, Bonaparte himself being appointed first consul for ten years. The other two consuls, were to have consultative voices only. Under the appearance of a republic it really established a military monarchy. The history of France for the next sixteen years is virtually the history of Napoleon. (See Napoleon I.) In 1802 the constitution was amended, Napoleon being made consul for life, with the right of appointing his successor. In 1804 he was proclaimed emperor, this being confirmed by a popular vote of 3,572,329 against 2569. The emperor was consecrated at Paris by Pius VII., and in 1805 he was also crowned King of Italy. For years the continental powers, whether singly or in coalitions, were unable to stand against him, though at sea France was powerless after the great victory by Nelson over the French and Spanish fleets at Trafalgar (1805). The Austrians and Russians were decisively defeated at the great battle of Austerlitz (1805); the king of Naples was dethroned and Napoleon's brother Joseph put in his place; another brother, Louis, was made king of Holland; while for a third, Jerome, the kingdom of Westphalia was erected (1807). Prussia was conquered and compelled to accede to humiliating terms. Napoleon was at the height of his power in 1810 and 1811, his empire then extending from Denmark to Naples, with capitals at Paris, Rome, and Amsterdam. By this time, however, the Peninsular War (see that art.) had broken out, which was one immediate cause of his downfall, the disastrous Russian campaign of 1812 being another. The latter cost the French the loss of at least 300,000 men. A new coalition was now formed against Napoleon, and in 1813 he was disastrously defeated by the allies at the great battle of Leipzig. By this time the Peninsular war was drawing to a close and Southern France was actually invaded by Wellington. The allies entered Paris on 31st March, 1814. Napoleon abdicated and received the island of Elba as a sovereign principality. Louis XVIII. was proclaimed king of France, and concluded the Peace of Paris (May 30, 1814). A congress of the great powers had assembled at Vienna to adjust European affairs, when it was announced that Napoleon had left Elba, returned to Paris 20th March, 1815, and been reinstated without resistance in his former authority. The allied sovereigns proclaimed him an outlaw and renewed their alliance against him. Napoleon, anticipating the attack, crossed the Sambre with 130,000 men, defeated Blücher in the battle of Ligny, and marched against the British, who had taken position at Waterloo. Here on the 18th was fought the decisive battle which resulted in his final overthrow. On the 7th July the allies entered Paris for the second time. Napoleon surrendered to the British and was sent to St. Helena as a prisoner.

Louis XVIII. at first governed with the support of a moderate liberal party, but the reactionary spirit of the aristocrats and returned émigrés soon got the upper hand; the country, however, was prosperous. Louis having died 16th Sept., 1824, his brother, Charles X., succeeded. On 26th July, 1830, the Polignac ministry, strongly reactionary in its tendencies published ordinances suppressing the liberty of the press and creating a new system of elections. The result was an insurrection during the three days 27th–29th July by which Charles X. was overthrown and Louis Philippe of Orleans proclaimed king 9th August, 1830. On 24th February, 1848, another revolution drove Louis Philippe into exile. A republic was proclaimed, and on the 10th December, 1848, Louis Napoleon, nephew of the great Napoleon was elected president for four years. The president, having gained the favor of the army, dissolved the legislative assembly on 2d December, 1851, put down all resistance in blood, and by this coup d'état established himself as president for the term of ten years. On 2d December the president was declared emperor under the title of Napoleon III. (a son of the great Napoleon being counted as Napoleon II.). In 1870 the uneasiness of Napoleon and the French at the steady aggrandizement of Prussia broke out into flame at the offer of the Spanish crown to a prince of the house of Hohenzollern. France, not satisfied with the renunciation of the German prince, demanded a guarantee from the King of Prussia that the candidature should never be resumed. This being refused France declared war. (See Franco-German War.) One French army was driven back by the Germans and cooped up in Metz, another was pushed northward to Sedan, and so hemmed in that it had to surrender with the emperor at its head. On the news of this disaster reaching Paris the republic was proclaimed. After an almost uninterrupted series of victories the Germans became masters of the French capital (28th January, 1871), and the war ended in France giving up to Germany Alsace and a part of Lorraine, and paying a war indemnity of five milliards of francs ($1,000,000,000). Meanwhile civil war had broken out in Paris, which was suppressed with great difficulty. (See Commune of Paris.) The assembly elected in 1871 for the ratification of peace with Germany found it expedient to continue their functions, Thiers being the head of the administration. In 1873 the Thiers administration was overthrown and replaced by one under Marshal MacMahon. In 1875 a republican constitution was drawn up. In 1879 MacMahon resigned his presidentship before its legal expiry, being succeeded by Jules Grévy, who has been followed by Carnot (assassinated), Casimir-Perier, Faure, Loubet, and Fallieres. In 1881 France occupied Tunis as a protectorate; the same year Primary Education was made compulsory and free; in 1883-84 France took possession of Tonquin, which led to hostilities with China. In 1885 Madagascar was reduced to submission. In 1906 Armand Fallieres was elected president. In 1907 the law separating church and state went into effect.

At the time of the conquest of Gaul by Julius Cæsar, the principal dialects spoken by the inhabitants were Celtic. After the conquest of Gaul by the Romans all these dialects were gradually supplanted by Latin except in Brittany, where a Celtic dialect still holds its

ground. The popular Latin of Gaul of course exhibited considerable differences from the written and classic Latin. It was still further modified by the influences introduced with the Teutonic invasions. The half-barbarous conquerors, incapable of mastering the intricacy of Latin inflections, mostly neglected them, using only the simpler forms. They enlarged the vocabulary also by a number of words, mostly terms of war, hunting, etc. After the Franks in Gaul had abandoned their native language and adopted this new Romanic or Romance tongue it became known as the Francisca, later Franceis, from which the modern term French is derived. At the beginning of the 16th century Francis I. prohibited the use of Latin at court and in the public tribunal and formally recognized the French as the national language. As one of the Romance languages it is a sister tongue of Italian, Spanish, and Portuguese.

French literature proper begins in the 11th century with the epic or narrative poems known as chansons de geste, and produced by the class of poets known as Trouvères. These poems belong to northern France and are very numerous. They are usually divided into three heads: poems relating to French history, in particular to the deeds of Charlemagne, his descendants and vassals; poems relating to Alexander the Great and to ancient history; and poems of the Arthurian cycle, or relating to King Arthur. They are generally written in verses of ten or twelve syllables, and are of a length varying from 1000 to 20,000 lines. One of the oldest and best examples of the first class is the Chanson de Roland, or Song of Roland.

An abundant lyric poetry flourished from the 11th century. This song literature is manily of a sentimental character, and is usually divided into two classes, romances and pastourrelles. It is in general remarkable for its lyric grace and skilful melody. François Villon (1431–1500), the greatest of French poets before the renaissance, wrote two compositions known as the Great and the Little Testament, interspersed with lyrical compositions of great poetic merit.

The revival of classical learning and the reformation of religion exercised a powerful infiuence on the French literature of the 16th century. Rabelais (1483–1553), a profound but often gross humorist, and Montaigne (1533–92), an interesting and instructive, though somewhat sceptical essayist, hold the first rank. Calvin (1509–64) did much by his great theological work, Institution de la Religion Chrétienne, to mould French prose in the direction of strength and gravity. With the renaissance translations of the classic dramas appeared, and a member of the Pléiade, Jodelle (1532–1573), wrote the first regular tragedy (Cléopatre) and comedy (Eugène). Pierre Corneille (1606–84), with his Cid, Cinna, Horace, and Polyucte, brought French tragedy to a epree of grandeur which it has not surassed. Of seventeenth century prose riters Pascal (1628–62) is vigorous and atirical in his Lettres Provinciales; profound, if sometimes mystical, in his Pensées. Descartes (1596–1650) showed in his Discours sur la Méthode that the language was now equal to the highest philosophical subjects.

The age of Louis XIV. is known as the golden age of French literature. Besides Corneille, Racine (1639–99) represented the tragic drama, and Molière (1639–93) brought his great masterpieces of comedy on the stage. The "inimitable" La Fontaine (1621–95) wrought his Contes and the most charming collections of fables. For his critical influence, if not for his poetry, Boileau (1636–1711) holds a prominent place. In eloquence the sermons and funeral orations of Bossuet, Bourdaloue, and Massillon take the first rank. Bossuet is also celebrated as a controversialist and theological historian. Very important, too, are the memoir and maxim writers of this time. Among the former are the Cardinal de Retz, Madame de Motteville, Madame de Sévigné (1627–96), and others; among the latter are La Rochefoucauld (1613–80), St. Evremond (1613–1703), La Bruyère (1639–99). In fiction Le Sage, who also wrote comedies, produced his immortal Gil Blas and the Diable Boiteux; and the versatile Fontenelle wrote his Dialogues des Morts.

Among the writers of the 18th century Voltaire holds the first place. He claims notice as an epic, lyrical, and comic poet, as a tragic and comic dramatist, as a historian, novelist, and philosopher, and he remained at the head of the republic of letters for more than half a century. Next to him in immediate influence on the age stands Jean Jacques Rousseau (1712–78), a writer of an eloquent sentimental vein, well represented by his Nouvelle Héloise and his famous Confessions. His new theories of politics and education are embodied in his Contrat Social and Emile. Buffon (1707–88) devoted himself to the production of his immense natural history. Montesquieu (1689–1755), commencing with the Lettres Persanes, a satire on French manners and government, followed with a historical masterpiece, Considérations sur la Grandeur et la Décadence des Romains, and finally with his great work, the Esprit des Lois. Diderot (1713–83), a powerful and suggestive writer in many departments, and D'Alembert (1717–83), a great geometrician, founded the Encyclopédie, a vast review of human knowledge, often hostile to social order and always to religion. Among the writers of fiction Bernardia de St. Pierre (1737–1814), author of Paul et Virginie, and Prévost (1697–1763), author of Manon Lescaut, are particularly worthy of mention; while dramatic literature was enriched by the Barbier de Séville and the Mariage de Figaro of Beaumarchais (1732–99).

Neither the revolution nor the first empire was favorable to literature. Châteaubriand (1768–1848) and Madame de Stael (1766–1817) gave a new turn to the taste and sentiment of the time, the former in his Génie du Christianisme and his Martyres, clothing the history of Christianity in the romantic hues of his imagination, the latter in her Corinne and De l'Allemagne introducing the idealistic spirit and thought of the Germans to her countrymen.

Later on in the 19th century the influence of Goethe, Schiller, Shakespeare, Scott, and Byron began to be felt, and a new school, called the romantic, as opposed to the old or classic, sprung up, headed by Victor Hugo (1802–85), who promulgated the new theories in the preface to his drama of Cromwell, and carried them into practice in numerous poems. On the stage the dramas of Alexandre Dumas, the elder (1803–74), though melodramatic and of inferior literary value, served as rallying points for the new school. To English readers, however, he is best known by his novels. Béranger (1780–1857), the greatest of French song-writers may be considered as belonging to neither of the two schools, nor can the sparkling comedies and vaudevilles of Eugène Scribe be claimed by any of the rival parties.

Among novelists, Balzac (1799–1850), by his astonishing series of works, intended to cover the whole ground of human life, has established his claim to the first place. The novels of George Sand (Madame Dudevant, 1804–76), perhaps equally famous, have gained her the reputation of possessing the finest style of any contemporary writer. Low life in Paris was vividly depicted by Eugène Sue (1804–57) in the Mystères de Paris, etc. Of a healty tone are the novels of Frédéric Soulié, Emile Souvestre, and Edmond About (1828–85), and the stories of the two novelists, conjoined in work as in name, Erckmann-Chatrian. The younger Dumas, Victorien Sardou, Octave Feuillet, Ernest Feydeau, Henri Murger, Gustave Flaubert have developed a realistic style of novel in which social problems are treated with more candor than delicacy. Of late years a school of writers has arisen who strive to outdo the most realistic of their predecessors. The chiefs of this school are Emile Zola, Emile Gaboriau, Victor Cherbuliez, Alphonse Daudet, etc.

FRANCE, Isle of, an ancient province of France, so called because it was originally bounded by the Seine, Marne, Ourcq, Aisne, and Oise, and formed almost an island.

FRANCESCA DA RIMINI (frân-ches' kȧ dȧ rē'mi-nē), an Italian lady, daughter of Guido da Polenta, lord of Ravenna lived in the latter part of the 13th century. She was married to Lanciotto, the deformed son of the lord of Rimini, who, discovering an intimacy between her and his brother Paolo, put them both to death. The story forms an episode in Dante's Inferno, and is alluded to by Petrarch; it is the subject of a poem by Leigh Hunt and a tragedy by Silvio Pellico.

FRANCHISE, in a general and legal sense, a particular privilege or right granted by a prince, sovereign, or government to an individual, or to a number of persons. In politics, in regard to which the term is most commonly used, it is the right of voting for representatives to a legislative assembly or to a municipal body.

FRANCIS I., King of France, was born 1494; died 1547. He ascended the throne in 1515, having succeeded his uncle, Louis XII.

FRANCIS II., King of France, son of Henry II. and Catherine of Medici, born at Fontainebleau in 1544, ascended the throne on the death of his father, 1559.

Francis I.

The year previous he had married Mary Stuart, only child of James V., king of Scotland. Francis, died in December, 1560.

FRANCIS I., Emperor of Germany, eldest son of Leopold, duke of Lorraine was born in 1708. In 1736 he married Maria Theresa, daughter of the Emperor Charles VI. After the death of Charles VI. (1740) he was declared by his wife co-regent of all the hereditary states of Austria, but without being permitted to take any part in the administration. After the death of Charles VII. he was elected emperor in 1745. He died in 1765.

FRANCIS I., Emperor of Austria (previously Francis II., emperor of Germany), was born 1768, died 1835. He was the son of the Emperor Leopold II. and Maria Louisa, daughter of Charles III., King of Spain. He succeeded his father in 1792. France having been declared an empire in 1804, he assumed the title of hereditary Emperor of Austria; and on the establishment of the confederacy of the Rhine in 1806, he renounced the title of Emperor of Germany.

FRANCIS OF ASSISI, ST., founder of the Franciscans, was born at Assisi, in Umbria, in 1182, where he died in 1226. In youth Francis did not refrain from the pleasures of the world; but after a serious illness he became enthusiastically devout, left the paternal roof, and in 1208 gave himself to a life of the most rigorous poverty. His followers were at first few, but when they reached the number of eleven he formed them into a new order, made a rule for them, and got it sanctioned, though at first only verbally, in 1210, by Pope Innocent III. In 1212 he received from the Benedictines a church in the vicinity of Assisi, which now became the home of the order of the Francisans or Minorites. Francis afterward obtained a bull in confirmation of his order, from Pope Honorius III. After an unsuccessful attempt to convert the Sultan Meledin he returned to Assisi, when the order of St. Clara was founded under his direction, and a third order, called the Tertiaries, designed for penitents of both sexes. He was canonized by Pope Gregory IX. in 1228. His festival is on the 4th of October. See Franciscans.

FRANCIS OF PAULA, ST., was born in 1416 in the city of Paula, in Calabria; died in France 1507. To the three usual vows of a monk Francis added a fourth, that of keeping the Lenten fast during the whole year. Twelve years after his death he was canonized by Leo X., and the Catholic Church celebrates his festival April 2.

FRANCIS, Sir Philip, one of the many political writers to whom the authorship of Junius' Letters has been ascribed, was born in Ireland in 1740, died 1818. See Junius.

FRANCIS'CANS, are the members of the religious order established by St. Francis of Assisi about 1210. They are also called Minorites, or Fratres Minores ("lesser friars"), which was the name given them by their founder in token of humility, and sometimes Gray Friars, from the color of their garment. The order was distinguished by vows of absolute poverty and a renunciation of the pleasures of the world, and was intended to serve the church by its care of the religious state of the people. The rule of the order destined them to beg and to preach. The popes granted them extensive privileges, and they had an evil repute as spies, frequenting the courts of princes and the houses of noblemen, gentry, etc. Early in the

Franciscan or gray friar (conventual),

15th century they split up into two branches, the Conventuals and the Observants or Sabotiers. The former went barefooted, wore a long gray cassock and cloak and hood of large dimensions, covering the breast and back, and a knotted girdle. The Observants wore wooden sandals, a cassock, a narrow hood, a short cloak with a wooden clasp, and a brown robe. In France the members of the order not belonging to any particular sect are called Cordeliers, from the cord which they tie about them. The Capuchins, so called from the peculiar kind of hood or cowl (capuce) which they wear, originated in a reform introduced among the Observantists by Matthew of Baschi in the early part of the 16th century.

St. Francis himself collected nuns in 1209. St. Clara was their prioress; hence they were called the nuns of St. Clara. The nuns were also divided into branches, according to the severity of their rules. The Urbanists were a branch founded by Pope Urban IV.; they revered St. Isabelle, daughter of Louis VIII. of France, as their mother. St. Francis also founded in 1221 a third order, of both sexes, for persons who did not wish to take the monastic vows, and yet desired to adopt a few of the easier observances. They are called Tertiarians or Tertiarise, and were very numerous in the 13th century. From them proceeded several heretical fraternities, as the Fraticelli and Beghards. The whole number of Franciscans and Capuchins in the 18th century amounted to 115,000 monks, in 7000 convents. At the dissolution of the monasteries in England there were sixty-five houses of the Franciscans. The order has given five popes and more than fifty cardinals to the church.

FRANCIS JOSEPH I., Emperor of Austria and King of Hungary and Bohemia, born 1830; succeeded his uncle, Ferdinand, who abdicated in 1849.

FRANCIS-JOSEPH LAND. See Franz-Joseph Land.

FRANCIS XAVIER, ST. See Xavier.

FRANCO-GERMAN WAR OF 1870–71. The immediate occasion of this war was an offer made in June, 1870, by General Prim, then at the head of affairs in Spain, of the crown of that country to Leopold of Hohenzollern, a prince belonging to the reigning house of Prussia. The government of Napoleon III. demanded of the King of Prussia that he should forbid the candidature of the prince, and when the prince voluntarily retired from his candidature, still insisted that this renunciation should be formally made by the king, and a guarantee given that the candidature would not be revived. This demand was refused, and a formal declaration of war by France against Prussia was received by Count Bismarck, the Chancellor of the North German confederation, on the 19th of July. The French were the first in getting their troops to the frontier; but it soon became manifest that instead of being in a complete state of readiness for war, as the minister of war had declared, the French army was defective in almost everything essential to the equipment of an army.

In Germany everything formed a complete contrast to this state of matters. Each section of the army was completely organized in the head-quarters of the district which it occupied in time of peace, and was only sent to the frontiers after being furnished with every thing it required. In addition to this Prussia, against which country alone the war had been declared, was not only joined, according to treaty, by all the states of the North German confederation, but also by those of the south, upon whose neutrality, perhaps even upon whose alliance, Napoleon and the French had counted.

The German forces were divided about the end of July into three armies, one of which, known as the first army, had its headquarters at Trèves under General Steinmetz; another of which, known as the second army, occupied the Bavarian

Palatinate under Prince Frederick Charles; while the third army, under the Crown-prince of Prussia, was stationed in Northern Baden. The commander- in-chief of the whole forces was King William of Prussia, who was supported by a staff of general officers, with Von Moltke at their head. The French army, under Napoleon himself, had its head-quarters at Metz, and two advanced divisions were stationed on the borders of France and Germany, the one in the north on the Saar, under General Frossard, the other further south at Weissenburg, under General Douay. The victories of the third army, under the crown-prince, at Weissenburg (Aug. 4) and at Wörth (Aug. 6), and of the first and second armies at Forbach (Aug. 6), put the French army in retreat along its whole line, the southern half in the direction of Nancy, and the northern of Metz. The northern army under Bazaine was overtaken by those of Steinmetz and Frederick Charles on the 14th of August, when an engagement at Courcelles took place, in which the Germans were again victorious. This was followed by the battles of Vionville, or Mars-la-Tour, and Gravelotte, the result being that Bazaine withdrew his army under the protection of the fortifications of Metz, which was now surrounded by an army under the command of Prince Frederick Charles.

Meantime the Crown-prince of Prussia had advanced as far as Nancy, and was there awaiting the result of the battles around Metz. He had still the army of MacMahon to deal with, which had now reached Châlons, where it had been reorganized and strengthened to such a degree that the army of the Crown-prince was no longer able to cope with it unaided. Accordingly, out of three corps d'armée belonging to the second army, a new army was formed, which was afterward called the army of the Meuse, and was placed under the Crown-prince of Saxony. About the 20th of August these two armies set out on parallel routes in the direction of Châlons in order to engage the army of MacMahon, which it was expected would now retreat on Paris. Instead of this, however Count Palikao, minister of war at Paris, issued an order to Marshal MacMahon to strike northward to the Belgian frontier that he might thence make a descent upon Metz and relieve Bazaine. On the 27th of August, at Buzancy, an advanced detachment of cavalry belonging to the army of the Meuse dispersed a body of French chasseurs, and on the days immediately succeeding a number of engagements and strategic movements ensued, the result of which was that on the 1st of September the army of MacMahon was surrounded at Sedan by a force of overwhelmingly greater numbers, and on the following day both army and fortress surrendered by capitulation. On this occasion 50 generals, 100 other officers, and 84,000 private soldiers became prisoners of war. Among these was Napoleon III., who was unexpectedly found to have been present with the army of MacMahon. He had a personal interview on the day after the battle with King William of Prussia, who assigned to him Wilhelmshöhe, near Cassel, as his place of residence during his captivity.

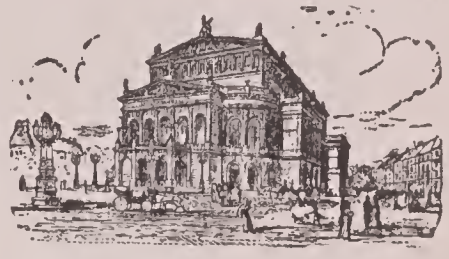
One of the first consequences of this defeat was an outburst of rage on the part of the Parisians against the Napoleon dynasty, which on the 4th of September was declared by Gambetta and some members of the corps législatif belonging to the left to be dethroned. The same members then proclaimed a republic. A government of national defense was formed, at the head of which was placed General Trochu. Meantime France had no availalble army which was strong enough to stand its ground for an instant before the German armies that were now enabled to continue their march upon Paris. The investment of the city was completed on the 19th of September. It was not till about the beginning of October that the French were able to organize a new army after the loss of that of MacMahon, and by the beginning of November the war in the open field had been resumed in different centers: but the capitulation of Metz with the army of Bazaine (28th Oct.), and that of Strasburg (27th Sept.), had set free for further operations large numbers of German troops, and the utmost efforts of the French could not relieve Paris.

The city had held out for a much longer period than even the most sanguine on the side of the French had at first expected that it would be able to do. Sallies were made at intervals by the garrison (Oct. 12, Oct. 21, etc.; Jan. 13, 14, 15, and 19), but not sufficiently often or in sufficient strength to have any decisive effect. On the failure of the last sally, which took place on the west side from Mont Valérien on the 19th of Jan., it was seen that a capitulation was inevitable. On 21st Feb. M. Thiers, head of the executive, arrived at Versailles along with a diplomatic commission, and preliminaries of peace were signed at Versailles on the 26th of Feb., and accepted by the assembly at Bordeaux on the 1st of March. The principal terms were the following:—1. That France should cede to Germany one-fifth part of Lorraine, including Metz, together with the whole of Alsace except Belfort and the surrounding district. 2. That France should pay to Germany a war indemnity of five milliards of francs ($1,000,000,000). 3. That certain departments of France should remain in the occupation of the Germans, and should not be fully evacuated until after the payment of the whole indemnity. The definitive treaty of peace, which was signed at Frankfort on the 10th of May, and ratified on the 21st, confirmed in all essential particulars the preliminaries of Versailles. The last installment of the war indemnity was paid on the 5th of Sept., 1873, and France completely evacuated by the Germans on the 13th of the same month.

FRANK, the signature of a person possessing the privilege of sending letters free of postage.

FRANKFORT, capital of Kentucky and of Franklin county, situated in a group of hills on both sides of the Kentucky river, and on the Louisville and Nashville and the Kentucky Midland Railway; 65 miles by rail e. of Louisville. Pop. 11,400.

FRANKFORT-ON-THE-MAIN, (German, Frankfurt am Main), a town of Prussia, in the province of Hessen-Nassau, 20 miles n.e. of Mayence(Mainz) It was formerly a free town of the empire, and down to 1866 one of the free towns of the German confederation and the seat of the diet. Frankfort is rich in collections connected with literature and art, and in establishments intended to promote them. The chief of these are

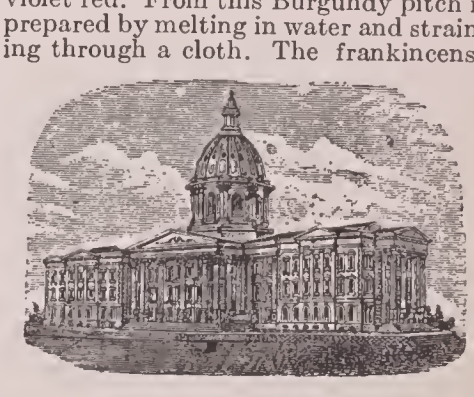


The Opera House, Frankfort.

the Historical Museum (in the Archive-building), the Städel Art Institute (in Sachsenhausen), containing a fine gallery of pictures and other collections; the Senckenberg Museum of Natural History; the town library, possessing over 150,000 printed volumes. There is also a Zoological garden and the Palm garden, both favorite places of resort. The manufactures comprise chemicals, ornamental articles of metal, sewing-machines, straw hats, soap, perfumery, beer, etc. Pop. 288,489.

FRANKFORT - ON - THE - ODER, a town of Prussia, province of Brandenburg, on the Oder, 52 miles e.s.e. Berlin. Pop. 61,852.

FRANK'INCENSE, a name given to the oleoresinous exudations from different species of conifers. American frankincense is got as a soft, yellow, resinous solid, with a characteristic turpentine odor. Another kind is exuded by the spruce fir, and forms a soft solid, the color of which varies from white to violet red. From this Burgundy pitch is prepared by melting in water and straining through a cloth. The frankincense



State capitol, Frankfort, Ky.

employed in religious ceremonies (called also incense) is a gum-resin obtained from a tree somewhat resembling the sumach and inhabiting the mountains of India. It comes to us in semi-transparent yellowish tears, or sometimes in masses, of specific gravity, 1·22, it possesses a bitter and nauseous taste, and is capable of being pulverized. When burned it exhales a strong aromatic odor, on which account it was much employed in the ancient temples, and still continues to be used in Catholic churches.

FRANKLIN, Benjamin, American writer and statesman, born at Boston Jan. 17, 1706, died at Philadelphia April 17, 1790. He was placed with his brother, a printer, to serve an apprenticeship to that trade, and his brother having started the New England Courant, Franklin secretly wrote some pieces for it, and had the satisfaction to find them well received. But, on this coming to the knowledge of his brother, he was severely lectured for his presumption, and treated with great harshness. Soon after he quitted his brother's employment, and at the age of seventeen started for Philadelphia, where he ob-

Benjamin Franklin.

tained employment as a compositor. Here he attracted the notice of Sir William Keith, the governor of Pennsylvania, who induced him to go to England for the purpose of purchasing type to establish himself in business. He got work in a printing-office, and after a residence of eighteen months in London returned to Philadelphia. Here he returned to his trade, and in a short time formed an establishment in connection with a person who supplied the necessary capital. They printed a newspaper, which was managed with much ability, and acquired Franklin much reputation. By his exertions a public library, improved systems of education, a scheme of insurance, etc., were established in Philadelphia. In 1732 he published his Poor Richard's Almanack, which continued to be issued till 1757. Being in Boston in 1746 he saw, for the first time, some experiments in electricity, which led him to begin those investigations which resulted in the identification of lightning and electricity, and the invention of the lightning conductor. As member of the provincial assembly of Pennsylvania he showed himself very active, and he was sent out (in 1757) to the mother country as the agent of the province. His reputation was now such, both at home and abroad, that he was appointed agent of the provinces of Massachusetts, Maryland, and Georgia. Oxford and Edinburgh conferred on him their highest academical degrees, and the Royal Society elected him a fellow. In 1762 he returned to America but was again appointed agent in 1764, and brought to England a remonstrance against the project of taxing the colonies. He opposed the stamp-act, and in 1774 presented to the king the petition of the first American congress. On his return he was elected member of the congress, and exerted all his influence in favor of the declaration of independence. In 1776 he was sent to France as commissioner plenipotentiary, to obtain supplies from that court. After the surrender of Burgoyne he concluded with France the first treaty of the new states with a foregin power (1778), and was subsequently named one of the commissioners for negotiating the peace with the mother country. On his return to his native country he filled the office of president of Pennsylvania, and served as a delegate in the federal convention in 1787, and approved the constitution then formed. His works include his unfinished autobiography, and a great number of political, anti-slavery, financial, economic, and scientific papers.

FRANKLIN, Sir John, an English Arctic voyager, born in Lincolnshire in 1786, died near Lancaster Sound 1847. He entered the navy as a midshipman at the age of fourteen, and was present at the battle of Copenhagen in 1801. He afterward accompanied Captain Flinders on his voyage to the coast of Australia (1801–03). Shortly after his return he was appointed to the Bellerophon, and had charge of her signals during the battle of Trafalgar. His arctic work began in 1819, when he conducted an overland expedition for the exploration of the n. coast of America from Hudson's Bay to the mouth of the Coppermine river. In a second expedition he surveyed the coast from the mouth of the Coppermine west to Point Beechy, thus traversing in his two expeditions about a third of the distance between the Atlantic and the Pacific. In 1845 he took command of the Erebus and Terror in what proved his last Polar Expedition. The problem was an arctic water-way between the Atlantic and the Pacific. The expedition was seen in Melville Bay two months later, but from that time no direct tidings were received from it. Many expeditions were sent in search of him both from Britain and America, but with little success. At last an expedition, sent out under McClintock in 1857, discovered in 1859, at Point Victory, in King William's Land, a document which had been deposited in a cairn thirteen years before, and gave the latest details of the ill-fated expedition. This paper stated that Sir John died 11th June, 1847; that the ships were abandoned in April, 1848; and that the crews, 105 in number, had started for the Great Fish River. None survived, but many relics of the party have been recovered.

FRANKS, a Germanic tribe or aggregate of tribes which overthrew the Roman dominion in Gaul, and gave origin to the name France. See France.

FRANZ-JOSEPH LAND, an island group in the Arctic Ocean, lying north of Nova Zembla, and consisting of two chief islands, much broke up by fiords, and a number of smaller ones.

FRASER RIVER, the principal river in British Columbia, rising in the Rocky Mountains. It first flows northwest for about 270 miles, then turns south, and after a total course of about 500 miles falls into the Gulf of Georgia. Gold is found both on the Fraser and its affluent and the salmon fisheries are important. Its principal affluents are the Thompson, Quesnelle, and Stuart rivers. New Westminster, Hope, Yale, and Lytton are on its banks.

FRATERNAL ORGANIZATIONS, Membership of, according to the last reports of the supreme bodies of these organizations, the membership of the principal fraternal organizations in the U. States and Canada is as follows:

Odd Fellows	1,521,095
Freemasons	1,229,001
Modern Woodmen of America	813,642
Knights of Pythias	622,466
Independent Order of Rechabites	488,000
Woodmen of the World	450,211
Improved Order of Red Men	406,774
Knights of the Maccabees	325,000
Royal Arcanum	283,011
Ancient Order of United Workmen	275,609
Independent Order of Foresters	250,000
Order of Eagles	250,000
Foresters of America	211,110
Benevolent and Protective Order of Elks	215,000
Ancient Order of Hibernians	210,000
Knights of Columbus	166,494
Junior Order United Amer. Mechanics	163,205
Ladies of the Maccabees	145,293
Knights of the Modern Maccabees	125,000
Ladies Catholic Benevolent Association	95,500
Tribe of Ben Hur	92,500
Knights and Ladies of Honor	92,000
Improved Order of Heptasophs	70,439
Knights of the Golden Eagle	70,431
National Union	62,444
Brotherhood of American Yeomen	61,671
Protected Home Circle	59,981
Catholic Mutual Benefit Association	57,673
Order of Gleaners	56,000
Court of Honor	55,393
Brith Abraham Order	53,853
New England Order of Protection	43,167
Knights of Honor	40,126
Ancient Order of Foresters	38,898
United Order of American Mechanics	36,554
Sons of Temperance	34,789
Independent Order of B'nai B'rith	28,539
Knights of Malta	27,000
Smaller organizations	379,819
Total	9,656,280

FRATERNITIES, the name given to societies of students at American colleges that are usually secret in character. They are called also Greek letter societies because the Greek alphabet usually is employed to designate them, being known by the letters which are the initials of their name. These societies usually are national in character having branches at various colleges which branches are known as chapters. The first Greek letter society, Phi Beta Kappa, was organized at William and Mary College in 1776. This society has become an honorary scholarship organization somewhat different from the more mysterious organizations of which the first was Kappa Alpha established at Union College in 1825. The mysteries in the fraternity are rarely very great and for the most part their only function is to cement ties of friendship among groups of students. Often the fraternities have club-houses known as chapter houses. At these initiations take place which are more or less formidable. Until recent years there was some opposition among the college authorities to the fraternities but with the abolition of some abuses in initiation the attitude of the faculty has changed.

FRATER'NITY, an association of men who unite to promote their common interest, business or pleasure. In this wide sense it includes all secret and benevolent societies, the monastic and sacerdotal congregations, the orders of knighthood, and also guilds, trades-unions, and the like. In a limited sense it is applied to religious societies for pious practices and benevolent objects. They were often formed during the middle ages, from a desire of imitating the holy orders. Many of these societies which did not obtain or did not seek the acknowledgment of the church, had the appearance of separatists, which subjected them to the charge of heresy. The pious fraternities which were formed under the direction of the church, or were acknowledged by it, were either required by their rules to afford assistance to travelers, to the unfortunate, the distressed, the sick, and the deserted, on account of the inefficiency of the police, and the want of institutions for the poor, or to perform certian acts of penitence and devotion. Of this description were the Fratres Pontifices, a brotherhood that originated in Tuscany in the 12th century, where they maintained establishments on the banks of the Arno, to enable travelers to cross the river, and to succor them in case of distress. A similar society was afterward formed in France, where they built bridges and hospitals, maintained ferries, kept the roads in repair, and provided for the security of the highways. Similar to these were the Knights and Companions of the Santa Hermandad (or Holy Brotherhood) in Spain; the Familiars and Cross-bearers in the service of the Spanish Inquisition; the Calendar Brothers in Germany the Alexians in Germany, Poland, and the Netherlands, etc. The professed object of the Alexians, so called from Alexius, their patron saint, was to visit the sick and imprisoned; to collect alms for distribution; to console criminals, and accompany them to the place of execution; to bury the dead, and to cause masses to be said for those who had been executed, or for persons found dead. There were also Gray Penitents (an old fraternity of an order existing as early as 1264 in Rome, and introduced into France under Henry III.), the black fraternities of Mercy and of Death; the Red, the Blue, the Green, and the Violet Penitents, so called from the color of their cowl; the divisions of each were known by the colors of the girdle or mantle. The fraternity of the Holy Trinity, was founded at Rome in 1548 by Philip de' Neri for the relief of pilgrims and the poor dismissed from the hospitals. The Brothers and Sisters of Charity are another fraternity whose hospitals are found in all the principal cities of Catholic christendom.

FRAUD, an act or course of deception deliberately practiced with the view of gaining an unlawful or unfair advantage such as the obtaining of goods under false pretenses, and the like. All frauds or attempts to defraud, which cannot be guarded against by common prudence are indictable at common law, and punishable arbitrarily according to the heinousness of the offense. Every species of fraud which the law takes cognizance of renders voidable every transaction into which it enters as a constituent material element. Fraud may be by false representation, concealment of material circumstances that ought to be revealed, underhand dealing, and by taking advantage of imbecility or intoxication. A constructive fraud in law is such fraud as is involved in an act or contract which, though not originating in any actual evil or fraudulent design, yet has a tendency to deceive or mislead other persons, or to violate public or private confidence, or to impair or injure the public interests.

FRAUNHOFER (froun'hō-fĕr), Joseph von, German optician, born 1787, died 1826. He ultimately became a partner in a manufactory of optical instruments at Munich. His many improvements in glass-making, in optical instruments, and in the polishing of lenses, have been eclipsed by his investigation of the innumerable dark fixed lines in the solar spectrum, known as Fraunhofer's Lines. The importance of this discovery can scarcely be overestimated. It led to the invention and use of the spectroscope, to the science of spectroscopy, and to all our present knowledge of solar and stellar chemistry. See Spectrum, Spectroscope, etc.

FRAZER, Persifor, American geologist, born in 1844 in Philadelphia, Pa. He was an aide on the U. States coast survey in 1862–63; in 1869–70 he was mineralogist and metallurgist on the U. States geological survey; in 1870–74 was professor of chemistry in the University of Pennsylvania, and from 1874 to 1882 was assistant in connection with the second geological survey of Pennsylvania. Among his contributions to science may be cited his explanation of the cause of the white color of the moon as observed by day. He was elected to the American philosophical society in 1871.

FRED'ERIC, Harold, American novelist, was born in Utica, N. Y., in 1856. His first important story, Seth's Brother's Wife, was followed by The Lawton Girl, The Return of the O'Mahoney; The Copperhead, a story of the civil war; and Marsena, a collection of keenly humorous character stories. The Damnation of Theron Ware, a brilliant analysis of religious life minutely realistic in detail, clever in conversation, and unfailing in psychic insight, was immediately recognized by the public as a human document. His last works are Gloria Mundi, and In the Marketplace. He died in 1898.

FREDERICK, a town in Maryland, 44 miles n.w. of Baltimore. It has an extensive trade, chiefly in live stock, grain, flour, tobacco, wool, etc. During the civil war it was occupied on different occasions by the opposing armies. Pop. 10,160.

FREDERICK I., Barbarossa (or, as the Germans call him, Rothbart, both surnames meaning "Red-beard"), German emperor, son of Frederick, duke of Suabia, was born 1121, and received the imperial crown in 1152 on the death of his uncle the Emperor Conrad III. His principal efforts were directed to the extension and confirmation of his power in Italy. In his first expedition to Italy in 1154 he subdued the towns of Northern Italy, and then got himself crowned at Pavia with the iron crown of Lombardy (April 1155), and afterward at Rome by Pope Adrian IV. with the imperial crown (June 1155). In 1188 he assumed the cross, and with an army of 150,000 men and several thousand volunteers set out for Palestine. After leading his army with success into Syria he was drowned in crossing the river Kalybadnus (now Selef), 1190.

FREDERICK II., Hohenstaufen, grandson of the preceding, born 1194, was son of the Emperor Henry VI. and of the Norman Princess Constance, heiress of the two Sicilies. He remained under the guardianship of Innocent III. till 1209, when he took upon himself the government of Lower Italy and Sicily. The imperial crown of Germany was now worn by a rival, Otho IV., whose defeat at the battle of Bouvines opened the way to Frederick, who in 1215, after pledging himself to undertake a crusade, was crowned at Aix-la-Chapelle. He died in the midst of his wars in 1250. He was one of the ablest and most accomplished of the long line of German emperors, and art, literature, commerce, and agriculture received every encouragement at his hands. He himself was a good linguist, was acquainted with natural history, was a minnesinger, and a writer on philosophy.

FREDERICK I., King of Prussia, son of the great elector, born 1657, died 1713. He succeeded his father as Elector of Brandenburg, in 1688; became King of Prussia in 1700; and was all his reign bitterly opposed to France.

FREDERICK II., King of Prussia, known as Frederick the Great, born 1712, died 1786. He was the son of Frederick William I., and the Princess Sophia Dorothea of Hanover, sister of George II. of England. The death of his father raised him to the throne in 1740, and it was not long before he asserted

Frederick the Great.

the claims of the house of Brandenburg to a part of Silesia then held by Maria Theresa. But his proposals being rejected, he occupied Lower Silesia in December, 1740, defeated the Austrians near Mollwitz, and at Czaslau (Chotusitz) and the first Silesian war was terminated by the peace signed at Berlin July 28, 1742, leaving Frederick in possession of Silesia. Soon the second Silesian war broke out, the result of which was equally favorable for Frederick. By the Peace of Dresden (Decem-

ber 15, 1745) he retained Silesia and acknowledged the husband of Maria Theresa, Francis I., as emperor. During the eleven following years of peace Frederick devoted himself to the domestic administration, to the improvement of the army, and at the same time to the muses. He encouraged agriculture, the arts, manufactures, and commerce, reformed the law, increased the revenues of the state, and perfected the organization of his army. which was increased to 160,000 men. Secret information of an alliance between Austria, Russia, and Saxony gave him reason to fear an attack and the loss of Silesia. He hastened to anticipate his enemies by the invasion of Saxony (1756), with which the Seven Years' war, or third Silesian war, commenced. This was a far more severe struggle than either of the former. In it Frederick had against him Austria, Russia, France, Sweden, and greater part of Germany, though Britain and some of the German states were on his side. He gained victories at Prague, Rossbach, Leuthen, Zorndorf, Torgau, Freiberg, but suffered severe defeats in the battles of Kollin, Hochkirch and Kunersdorf. The Peace of Hubertsburg (1763) terminated this war, Frederick keeping Silesia and ceding nothing. On the partition of Poland in 1772 Frederick received a large accession to his dominion. In 1778–79 he frustrated the designs of the Emperor Joseph II. on Bavaria, and the war of the Bavarian Succession was terminated without a battle by the Peace of Teschen (May 13, 1779). Austria consented to the union of the principalities of Franconia with Prussia, and renounced the feudal claims of Bohemia to those countries. In the evening of his active life Frederick concluded, in connection with Saxony and Hanover, the confederation of the German princes, July 23, 1785. An incurable dropsy hastened the death of Frederick, who left to his nephew, Frederick William II., a kingdom increased by 29,000 square miles, a well-filled treasury, an army of 200,000 men, great credit with all the European powers, and a state distinguished for population, industry, wealth and science.

FREDERICK III., Emperor of Germany, born 1831, succeeded William I. March 9, 1888, died June 15, 1888. In 1858 he married the Princess-Royal of Britain, eldest daughter of Queen Victoria. He commanded the army of the Oder in the war with Austria (1866), and in the Franco-German war he led the army which ultimately forced Napoleon III. and his army to surrender at Sedan. He also took a prominent part in the siege of Paris. In 1887 he was attacked by a serious throat affection, which turned out to be of a cancerous character, and which after a series of relapses proved fatal. His renown as a military commander, his liberal views, his patience and fortitude under trouble, and his many lovable qualities made him extremely popular.

FREDERICK AUGUSTUS II. and III., electors of Saxony and kings of Poland. See Augustus.

FREDERICK CHARLES, Prince, known as the "Red Prince," born 1828, died 1885. He was nephew to the Emperor William I., and gained fame for his military exploits during the wars of 1866 and 1870. Sadowa, Thionville, Gravelotte, and St. Privat are among his chief achievements.

FREDERICK WILLIAM, of Prussia, generally called the Great Elector, was born in 1620, died 1688. At the age of twenty he succeeded his father as elector of Brandenburg. He must be considered as the founder of the Prussian greatness, and as the creator of a military spirit among his subjects. His reign began when the unhappy Thirty Years' war was was still raging in Germany, and his conduct toward both parties was prudent. He succeeded in freeing Prussia from feudal subjection to Poland; and obtained possession of Pomerania in 1648. In 1672 he concluded a treaty with the Dutch Republic, when this state was threatened by Louis XIV. In 1673 he concluded a treaty by which France promised to evacuate Westphalia, and to pay 800,000 livres to the elector, who, in return, broke off his treaty with Holland, and promised not to render any aid to the enemies of France. In 1674 the German Empire declared war against France. The elector marched 16,000 men into Alsace, but a Swedish army having been induced to invade Prussia, Frederick turned back and totally defeated them at Fehrbellin (1675). Some years after the Swedes again invaded his territories, but were driven back. France, however, demanded the restoration of all the conquered territories to Sweden. The elector, having refused compliance, formed an alliance with Denmark, and waged a new war against Sweden, but was at last obliged to submit. He paid great attention to the promotion of agriculture and horticulture, and, by affording protection to the French refugees, gained 20,000 industrious manufacturers, who were of the greatest advantage to the north of Germany. Berlin was much improved during his reign. He left to his son a country much enlarged and improved, an army of 28,000 men, and a well-supplied treasury.

FREDERICK WILLIAM I., King of Prussia, son of Frederick I. and father of Frederick the Great (II.), was born in 1688, died 1740. While crown-prince (1706) he married Sophia Dorothea, daughter of the Elector of Hanover, afterward George I. of England. On his accession to the throne, in 1713, he endeavored to increase the army and reform the finances, and became the founder of the exact discipline and regularity which have since characterized the Prussian soldiers. He was very miserly, eccentric, and arbitrary. He opposed Charles XII., and was the protector of the neighboring protestant states. His ridiculous fondness for tall men is well known. He left behind him an abundant treasury, and an army of about 70,000 men. His affairs were in the greatest order and regularity, and to his energy Prussia was much indebted for that prosperity and success which distinguished her till she was humbled by the power of Napoleon.

FREDERICK WILLIAM II., King of Prussia, born 1744, died 1797. He succeeded his uncle Frederick the Great in 1786, and shared in the second partition of Poland.

FREDERICK WILLIAM III., son of Frederick William II., born 1770, died 1840. During his reign Prussia suffered much at the hands of Napoleon, including defeats at Jena, Eylau, Friedland, etc., and lost a large portion of territory, which, however, was recovered after the fall of Napoleon.

FREDERICK WILLIAM IV., King of Prussia, son of Frederick William III., was born 1795, died 1861. He was carefully trained by the best masters in all the leading branches of knowledge and art, civil and military. He took part, though without any active command, in the campaigns of 1813—14. When he succeeded to the throne by the death of his father in 1840 his first proceedings were both of a popular and praiseworthy character. He soon, however, began to pursue a retrograde and absolutist policy. The popular movement which followed the French revolution of 1848 was at first met by the king with firmness, but on the demand of the people that the troops should be withdrawn from the capital, backed by an attack on the arsenal, the king offered concessions, which, however, he retracted on his power becoming more secure. Latterly his mind gave way, and he sank into a state of hopeless imbecility, which rendered it necessary to appoint this brother William regent of the kingdom He died without issue, and was succeeded by his brother, who ten years later became emperor of united Germany.

FREDERICTON, the capital of New Brunswick, Dominion of Canada, on the river St. John, about 84 miles from its mouth, and 54 miles n.n.w. of the town of St. John. It is well laid out, and has handsome public buildings, including the government house, the provincial buildings, court-house, town-hall, cathedral, university, etc.. The trade is extensive and increasing, the river being navigable for large steamers. Pop. 8117.

FREE CITIES, cities having an independent government of their own, and virtually forming states by themselves; a name given to certain cities of Germany which were members of the German confederation, and exercised sovereign jurisdiction within their own boundaries. At the time of the French Revolution the free or "imperial" cities numbered no fewer than fifty-one; but with the exception of Hamburg, Lübeck, and Bremen they have all been deprived of their privileges as the result of various political changes.

FREE COMPANIES, Free Lances names given to the troops of private adventurers, who, in the middle ages, organized themselves into bands of mercenary soldiers, and let out their services to the highest bidder. They played their most conspicuous part in Italy, where they were called Condottieri.

FREE CONGREGATIONS, sometimes called "Protestant Friends," a sect of German rationalists, who at first professed to be Christians, but now reject the doctrines of miraculous revelation and a personal deity. There are upwards

of 120 congregations of them in Germany, and a few in the U. States.

FREEDMEN, was the name applied by the Romans to those persons who had been released from a state of servitude. The freedman wore a cap or hat as a sign of freedom (hence the origin of the cap of liberty), assumed the name of his master, and received from him a white garment and a ring. With his freedom he obtained the rights and privileges of a Roman citizen of the plebian rank, but could not be raised to any office of honor.

FREEDOM OF THE CITY, distinguished visitors are sometimes the recipients of this honor which is in effect the making of such persons an honorary citizen. The custom of such a grant is a survival from medieval times when cities were close corporations and the right of citizenship could not be acquired until after a long term of residence usually seven years after enrollment. In those days when it was desired to honor a man by the abolition of the apprenticeship the magistrates would confer the freedom of the city by vote.

FREEHOLD, in law, an estate in real property, held either in fee-simple or fee-tail, in which case it is a freehold of inheritance, or for the term of the owner's life; also, the tenure by which such an estate is held.

FREE LANCES. See Free Companies.

FREE LIBRARIES. See Libraries.

FREEMAN, Edward Augustus, English historian and archæologist, born 1823, died in 1892. His works, which are very voluminous, include History of Architecture, 1849; History and Conquests of the Saracens, 1656; History of Federal Government, 1863; Old English History, 1869; Growth of the English Constitution, 1872; Historical Essays, 1872–79; History of the Norman Conquest, 1867–76; Historical Geography of Europe, 1881; the Reign of William Rufus, 1882; History of Sicily (unfinished), 1891–92; etc.

FREEMASONRY, a term applied to the organization of a society calling themselves free and accepted masons, and all the mysteries therewith connected. This society, if we can reckon as one a number of societies, many of which are unconnected with each other, though they have the same origin and a great similarity in their constitution, extends over almost all parts of the globe, and is consequently of the greatest service to travelers who are members of the craft. According to its own peculiar language it is founded on the practice of social and moral virtue. It claims the character of charity in the most extended sense; and brotherly love, relief, and truth are inculcated in it. Fable and imagination have traced back the origin of freemasonry to the Roman Empire, to the Pharaohs, the temple of Solomon, the Tower of Babel, and even to the building of Noah's ark. In reality it took its rise in the middle ages along with other incorporated crafts. Skilled masons moved from place to place to assist in building the magnificent sacred structures—cathedrals, abbeys, etc.—which had their origin in these times, and it was essential for them to have some signs, by which, on coming to a strange place, they could be recognized as real craftsmen and not imposters. Freemasonry in its modified and more modern form dates only from the 17th century. The modern ritual is said to have been partly borrowed from the Rosicrucians and knights templars, and partly devised by Elias Ashmole, the founder of the Ashmolean Museum. Freemasonry, thus modified, soon began to spread over the world. In 1725 it was introduced into France by Lord Derwentwater; and in 1733 the first American lodge was established. The United Grand Lodge of England recognizes only two species of Freemasonry—the Craft and the Royal Arch; Scotch, Irish, American, and Continental lodges acknowledge higher degrees; but these, with the exception of the mark degree, are not universal. In ordinary freemasonry there are three grades—those of apprentice, fellow-craft, and master-mason—each of which has its peculiar initiatory ceremonies; the last of these grades, however, is necessary to the attainment of the full rights and privileges of brotherhood.

FREEPORT, county seat of Stephenson co., Ill., 120 miles w. by n. of Chicago; the seat of a Presbyterian college, and manufactures machinery, carpets, etc. Pop. 16,210.

FREE SOIL PARTY, one of the ancestors of the republican party with which it was merged in 1856. During its eight years existence the free soil party's purpose was to prevent the extension of slavery in the territories. Displeased with the refusal of the democratic and whig national conventions to take a stand on the question of the free soil advocates held a national convention at Buffalo in August, 1848, and nominated a presidential ticket which received 291,263 popular votes but no electoral votes. Among its leaders were Chase and Sumner.

FREESTONE. See Sandstone.

FREETHINKERS, an epithet applied to the English Deists of the 17th and 18th centuries who argued for natural as against revealed religion. Anthony Collins (who first made it a name of a party by his Discourse of Free-thinking, London, 1713), and his friend, John Toland, are among the chief of the early freethinkers. Another able writer on the same side was Math. Tindal (died 1733), whose Christianity as Old as the Creation (1730) caused a great sensation. Lord Bolingbroke and Hume take the lead among advanced freethinkers. In France Voltaire and the encyclopedists D' Alembert, Diderot, and Helvetius led the opposition against revealed religion. The same spirit became fashionable in Germany in the reign of Frederick the Great. The term is now generally applied to designate Rationalists in general who are to be found among Christians as well as non-Christians.

FREE-TRADE, the term applied to national commerce when relieved from such interference as is intended to improve or otherwise influence it; that is, unrestricted by laws or tariffs, and not unduly stimulated by bounties. In all countries it was long held to be of importance to encourage native production and manufactures by excluding from their own markets, and from the colonial markets over which they had control the competing produce and manufactures of other countries. On this theory the great body of British commercial legislation was founded until 1846, when the policy of free-trade was introduced in grain, and afterward gradually extended by the repeal of the navigation laws in 1849 and other great measures, until nearly all British commercial legislation has been brought into conformity with it. Free-trade can hardly yet be said to have been adopted as a principle of commercial policy by any nation except Great Britain. As an economical principle free-trade is the direct opposite to the principle or system of protection, which maintains that a state can reach a high degree of material prosperity only by protecting its domestic industries from the competition of all similar foreign industries. To effect this protecting countries either prohibit the importation of foreign goods by direct legislation, or impose such duties as shall, by enhancing the price, check the introduction of foreign goods. The advocates of what is called fair trade in Britain profess a preference for free-trade were it universal or even common; but seeing that Britain is almost the sole free-trade country in the world, declare that a policy of reciprocity is required for the protection of British traders and manufacturers. The progress made by Britain since 1846 is adduced as a striking proof of the wisdom of a free-trade policy, even without reciprocity.

FREEZING, CONGELATION, or **SOLIDIFICATION,** the transformation of a liquid into a solid under the influence of cold. Each liquid always solidifies at the same temperature, which is called its freezing-point, and the solid also melts again at the same temperature. Thus the freezing-point and the melting point, or point of fusion, are the same, and the point is always the same for the same substance. Consequently the freezing-point of water, or the melting-point of ice (32° Fahr.), is taken for one of the fixed points in thermometry. The freezing-point of mercury is 39° below zero, of sulphuric ether 46° below zero, of alcohol 203° below zero Fahr. It has been shown that the increase of pressure upon water, and upon all substances which expand in freezing, will lower the freezing-point; and that such substances as wax, spermaceti, sulphur, and paraffin, which contract in freezing, have the freezing-point raised by pressure. Artificial freezing is attained by the liquefaction of solids or the evaporation of liquids. These processes absorb heat, and by abstracting it from the surrounding substances freeze the latter. Among freezing-mixtures are: (1) two parts of pounded ice or fresh snow and one part of common salt, which causes the thermometer to fall to −4°; (2) equal parts of water, of powdered crystallized nitrate of ammonia, and of powdered crystallized carbonate of soda, which produces a cold of −7°; (3) three parts of snow with four parts of crystallized chloride of calcium, producing a temperature of −54°; while (4) with a mixture of liquid

nitrous oxide and carbon disulphide a temperature of −220° is reached.

FREEZING, FUSING, and BOILING POINTS:

Substances.	Reaumur.	Centi-Grade.	Fahrenheit.
Bromine freezes at	− 17.6°	− 22°	− 7.6°
Olive Oil freezes at	8	10	50
Quicksilver freezes at	− 31.5	− 39.4	− 39
Water freezes at	0	0	32
Bismuth metal fuses at	211	264	507
Copper fuses at	963	1,204	2,200
Gold fuses at	1,105	1,380	2,518
Iron fuses at	1,230	1,538	2,800
Lead fuses at	260	325	617
Potassium fuses at	50	62.5	144.5
Silver fuses at	800	1,000	1,832
Sodium fuses at	76.5	95.6	204
Sulphur fuses at	92	115	239
Tin fuses at	182	228	442
Zinc fuses at	329.6	412	773
Alcohol boils at	63	74.4	167
Bromine boils at	50	63	145
Ether boils at	28.4	35.5	96
Iodine boils at	140	175	347
Water boils at	80	100	212

Authorities vary on some of these points. The best are given.

FRELINGHUYSEN, Frederick Theodore, American lawyer and political leader was born in Millstone, N. J., in 1817. In 1866 he was appointed by Governor Ward a U. States senator, to fill the vacancy caused by the death of William Wright. In 1871 he was elected to the U. States senate. After the disputed election of 1876 he was one of the framers of the bill creating the electoral commission, and after the commission was constituted, in 1877, served as one of its members. After several years spent in the active practice of his profession, he again entered political life, as the successor of James G. Blaine as secretary of state in the cabinet of President Arthur. He died in May, 1885.

FREMONT, county seat and capital of Sandusky co., Ohio. It has a considerable trade, lines of steamers running from the city, which stands at the head of steam navigation on the river Sandusky, to the principal ports of Lake Erie. Pop. 11,417.

FREMONT, John Charles, American explorer, born at Savannah, Georgia, 1813. He conducted five separate and adventurous expeditions which explored the passes of the Rocky Mountains, and practically opened up the great far west. He took an active part in the conquest of Upper California, and served in the civil war. Latterly he became a lawyer and an active promoter of railroads. He died in 1890.

FRENCH BEANS, or **KIDNEY-BEANS,** the haricots of the French, are the products of a native of the East Indies, but now commonly cultivated in all parts of the globe. This plant is a twining annual, bearing alternative leaves, on footstalks, composed of three oval pubescent folioles. The flowers are whitish, somewhat resembling those of the pea. The seeds are more or less kidney-shaped.

FRENCH, Daniel Chester, American sculptor, born at Exeter, N. H., 1850. The Minute Man, and the Gallaudet Monument in Washington and his relief Death and the Sculptor exhibited at the World's Fair in Chicago are among his best known works, but his monuments are scattered throughout the country.

FRENCH HONEYSUCKLE, the inappropriate name of a leguminous plant, a common perennial in gardens, where it is grown for the sake of its beautiful scarlet flowers. In Sicily and Spain it is largely cultivated as a green crop, yielding an enormous quantity of herbage.

FRENCH POLISH, a solution of shell-lac in alcohol, used for giving a smooth surface-coating to furniture and cabinet work. The most common of the varnishes known under the name of French polish are prepared as follows: Pale shell-lac, 5½ oz.; finest wood-naphtha, 1 pint: dissolve. Or pale shell-lac, 3 lb.; wood-naptha, 1 gallon. Methylated spirit (68 o.p.) may be substituted for the naptha in the above furmulæ. These varnishes are sometimes colored to modify the character of the wood. A reddish tinge is imparted by dragon's-blood or red sanders-wood, and a yellowish tinge by gamboge or turmeric-root.

FRENCH REVOLUTION. See France.

FRENEAU' (fre-nō'), Philip, the first genuine American poet of marked ability. His poetry is largely satirical. The beautiful lyric "The Indian Burying Ground," "The Wild Honeysuckle," and "Eutaw Springs" have had a permanent and enduring fame. He died in 1832.

FRESCO PAINTING, a method of mural painting in water colors on fresh or wet grounds of lime or gypsum. Mineral or earthy pigments are employed, which resist the chemical action of lime. In drying, the colors are incorporated with the plaster, and are thereby rendered as permanent as itself. In producing fresco paintings, a finished drawing on paper, called a cartoon, exactly the size of the intended picture, is first made, to serve as a model. The artist then has a limited portion of the wall covered over with a fine sort of plaster, and upon this he traces from his cartoon the part of the design suited for the space. As it is necessary to the success and permanency of his work that the colors should be applied while the plaster is yet damp, no more of the surface is plastered at one time than what the artist can finish in one day. A portion of the picture once commenced, needs to be completely finished before leaving it, as fresco does not admit of retouching after the plaster has become dry. On completing a day's work, any unpainted part of the plaster is removed, cutting it neatly along the outline of a figure or other definite form, so that the joining of the plaster for the next day's work may be concealed. The art is very ancient, remains of it being found in India, Egypt, Mexico, etc. Examples of Roman frescoes are found in Pompeii and other places. After the beginning of the 15th century fresco painting became the favorite process of the greatest Italian masters, and many of their noblest pictorial efforts are frescoes on the walls of palaces and churches. Some ancient wall-paintings are executed in what is called Fresco Secco, which is distinguished from true fresco by being executed on dry plaster, which is moistened with lime water before the colors are applied.

FRESNEL (frā-nel), Augustin Jean, French physicist, born 1788, died 1827. He did much to establish the undulatory theory of light, made several important discoveries in the polarizing of light, and greatly improved the apparatus for lighting lighthouses.

FRESNO, a city and county seat of Fresno county, Cal., 270 miles southeast of San Francisco, on the Southern Pacific and the Atchison, Topeka & Santa Fe railroads. Pop. 14,514.

FRETS, certain short wood, ivory, or metal cross-bars on the finger-boards of stringed instruments, as the guitar, etc., which regulate the pitch of the notes. By pressing the string down to the finger board behind a fret only so much of the string can be set in vibration as lies between the fret and the bridge.

FREYCINET (frā-si-nā), Charles Louis de Saulces de, French statesman, born at Foix (Ariége) 1828. He was trained as an engineer, and held several important appointments; he was elected to the senate in 1876; was minister of public works 1877; minister for foreign affairs 1877–79; and president of the council and minister for foreign affairs for longer or shorter periods in 1879, 1880, 1882, 1885, and 1886. He is the author of several important works on engineering.

FREYTAG (frī'tâh), Gustav, German poet, dramatist, and novelist, born 1816. He was editor of the Leipzig Grenzboten from 1848 to 1870, and has produced numerous successful plays, tales, and poems. Among his more famous works are: Debit and Credit; Pictures from the German Past; The Lost Manuscript; and Our Ancestors, a series of six romances illustrative of old German life. He died in 1895.

FRIAR, in the Roman Catholic Church an appellation common to the members of all religious orders, but more especially to those of the four mendicant orders, viz. (1) Minors, Gray Friars, or Franciscans, (2) Augustines; (3) Dominicans or Black Friars; (4) White Friars or Carmelites.

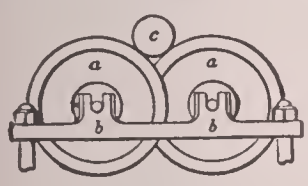
FRICASSEE (fri-kas-sē'), a dish of food made by cutting chickens, rabbits, or other small animals into pieces, and dressing them with a strong sauce in a frying-pan or a like utensil.

FRICTION, in physics, the effect of rubbing, or the resistance which a moving body meets with from the surface on which it moves. Friction arises from the roughness of the surface of the body moved on and that of the moving body. No such thing can be found as perfect smoothness of surface in bodies. In every case there is, to a less or greater extent, a roughness or unevenness of the parts of the surface, arising from peculiar texture, porosity, and other causes and therefore when two surfaces come together the prominent parts of the one fall into the cavities of the other. This tends to prevent or retard motion, for in dragging the one body over the other an exertion must be used to lift the prominences over the parts which oppose them. What is called the coefficient of friction for any two surfaces is the ratio that subsists between the force necessary to

move one of these surfaces horizontally over the other, and the pressure between the two surfaces. Thus the coefficient of friction for oak and cast-iron is 38:100, or ·38. Friction plays a most important part in nature and art; for instance, but for it threads could not be made nor textile fabrics manufactured.

FRICTION-ROLLERS, a name common to any small rollers or cylinders employed to convert sliding motion into rolling motion. Such cylinders are often placed under heavy bodies when they are required to be moved any short distance on the surface of the ground; and, in machinery, the same method is occasionally employed to diminish the friction of a heavily-loaded axis. In that case a number of small cylinders are inclosed round the axis, and partake of its motion.

FRICTION-WHEELS, in machinery, two simple wheels or cylinders intended to assist in diminishing the friction of a horizontal axis. The wheels are simply plain cylinders a, a, carried on parallel



Friction-wheels.

and independent axes b, b. They are disposed so as to overlap pair and pair at each end of the main axis c, which rests in the angles thus formed by the circumferences. The axis, instead of sliding on a fixed surface, as in ordinary cases, carries round the circumferences of the wheels on which it is supported with the same velocity as it possesses itself, and in consequence of the friction of the system is proportionately lessened.

FRIDAY, the sixth day of the week, from the Anglo-Sax. Frige-dæg, the day sacred to Frigga or to Freya, the Saxon Venus. See Good Friday.

FRIEDRICH, the German form of Frederick.

FRIENDLY ISLANDS, or **TONGA ISLANDS,** a cluster in the South Pacific Ocean, between lat. 18° and 23° s., and lon. 173° and 176° w. They consist of three groups, which are divided from each other by two narrow channels, and number altogether about 150, with a collective area of about 400 sq. miles The islands are nearly all volcanic, with coral reefs and rocks about them; earthquakes and volcanic eruptions are frequent, during one of which, in Oct., 1885, a new island 2 miles in circumference suddenly appeared. These islands were discovered in 1643 by Tasman, but received their collective name from Cook. They are now governed by a native Christian prince. The trade is considerable, the chief exports being copra, coffee, and wool. Pop. estimated at 17,500.

FRIENDLY SOCIETY, the name of English benefit associations established by the workingmen themselves for certain forms of self-help, but now developed into mutual insurance societies. The benefits given by friendly societies are generally for sickness and funeral allowances. Other forms of benefit sometimes found are: endowments, insurance for shipwrecks, loss or damage to boats, tools, or implements, medical aid dispensaries, widows' and orphans' funds, convalescent homes, asylums for the aged, and traveling relief for those out of employment. The strongly centralized societies have no social union, but only a business relationship with their members, as the dues are paid through agents or the post-office.

FRIENDS, THE SOCIETY OF, the denomination of Christians known as Quakers, dating from about 1647. In spite of cruel and severe persecutions, the Friends succeeded in establishing themselves in Europe and America. They have never been numerically powerful, having at no time exceeded, if indeed they have ever reached, 200,000 members; but the purity of life which has so honorably distinguished them as a class, has unquestionably exercised a salutary influence on the public at large; while in respect to certain great questions affecting the interests of mankind, such as war, slavery, and oaths, they have, beyond all doubt, originated or emphasized opinions and tendencies which are no longer confined to themselves, but have widely leavened the mind of Christendom.

FRIENDS. See Quakers.

FRIESLAND, the most northerly province of Holland, sometimes called West Friesland to distinguish it from East Friesland, now the district of Aurich in Hanover. It is generally flat, and parts of it are below sea-level. The area is 1281 sq. miles, four-fifths of which are under cultivation. Leeuwarden is the capital. Pop. 333,435. See Frisians.

FRIEZE (frēz), a kind of coarse woolen stuff or cloth, with a nap on one side.

FRIEZE (frēz), in architecture, that part of the entablature of columns which lies between the architrave and cornice. It is a flat member or face, usually enriched with figures or other ornaments of sculpture. See Entablature.

FRIG'ATE, in the navy, among ships of war of the older class, a vessel of a size larger than a sloop or brig and less than a ship of the line; usually carrying her guns (which varied from about thirty to fifty or sixty in number) on the main deck and on a raised quarter-deck and forecastle, or having two decks. Such ships were often fast sailers, and were much employed as cruisers in the great wars of the 18th and early part of the 19th centuries. Since the introduction of iron-clad vessels the term crusier has been applied to ships taking the place of the frigates of former days.

FRIGATE-BIRD, or **MAN-OF-WAR BIRD,** a tropical web-footed bird of the family Pelecanidæ. Including the long tail the male bird reaches 3 feet in length, but the body is comparatively small. The bill is longer than the head, strong, hooked at the point, and sharp. In proportion to their size their wings are longer than in any other bird, having an extent of 7 feet or more. Their flight is powerful and graceful; they neither swim nor wade, but catch the flying-fishes in the air, and cause fishing-birds to disgorge their prey, which they dexterously seize as it falls.

Frigate-bird.

FRIGGA, or **FRIGG,** in northern mythology, the wife of the god Odin, the goddess after whom Friday is named. She is a goddess in some respects corresponding with Venus.

FRILLED LIZARD, an Australian lizard, so called from a curious membrane-like ruff or tippet round its neck, covering its shoulders, and which lies

Frilled-lizard.

back in plaits when the animal is tranquil, but which elevates itself when it is irritated or frightened. A full-grown specimen is about 3 feet in length.

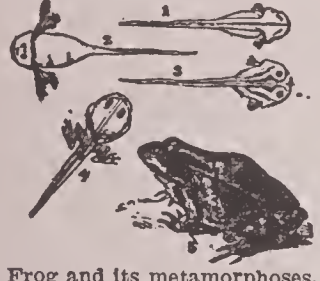
FRINGE-TREE, a small tree belonging to the same natural family with the olive, and having snow-white flowers which hang down like a fringe, inhabiting America from lat. 39° to the Gulf of Mexico. It is frequently cultivated in gardens as an ornamental plant. Four other species are known, two of which inhabit the West Indies, the third Ceylon, and the fourth Australia.

FRISIANS, a German tribe who, about the beginning of the Christian era, occupied the territory between the mouths of the Rhine and the Ems. They became tributaries of Rome under Drusus, and lived for some time on friendly terms with their conquerors, but were driven to hostilities by oppression. In time they extended as far eastward as Slesvig, and even made settlements on the Firth of Forth, and probably in other parts of Northern Britain. About the end of the 7th century the Frisians in the southwest were subdued by the Franks under Pépin d'Héristal, who compelled them to accept Christianity. A century later the eastern branch of the tribe was con-

quered and christianized by Charlemagne. Their country was divided into three districts, two of which were annexed on the division of the Carlovingian Empire to the possessions of Louis the German, and the other to those of Charles the Bald. The latter part was called West Frisia (W. Friesland), and the two former East Frisia (E. Friesland). Their modern history is chiefly connected with Holland and Hanover. The Frisian language holds in some respects an intermediate position between Anglo-Saxon and Old Norse. Of all the Teutonic dialects it is the most nearly related to English. Its ancient form exists only in some remarkable collections of laws. Three dialects of it are now recognized: the West Frisian, spoken in the Dutch province of Friesland, about Leeuwarden, Bolsward, etc., and used to some extent in literature; the East Frisian, spoken between the mouths of the Ems and Weser; and the North Frisian, spoken on the west coast of Schleswig, and South Jutland, and on the islands Sylt, Föhr, Amrun, etc.

FROEBEL (freu'bĕl), Friedrich Wilhelm August, German educationist, born 1782, died 1852. After an unsettled and aimless youth, and with somewhat imperfect culture, he started teaching, and soon developed a system which has become famous under the name of Kindergarten. He is the author of Human Education, and Mutter-und-Kose-lieder, a book of poetry and pictures for children.

FROG, the common English name of a number of animals belonging to the class Amphibia, having four legs with four toes on the fore feet and five on the hind, more or less webbed, a naked body, no ribs, and no tail. Owing to the last peculiarity frogs belong to the order of amphibians known as Anura or tailless Amphibia. The tongue is fleshy, and is attached in front to the jaw, but is free



Frog and its metamorphoses.
1, 2, 3, 4, Various stages of tadpole state; 5, fully formed animal.

behind, so that the hinder extremity of the tongue can be protruded. Frogs are remarkable for the transformation they undergo before arriving at maturity. In the spring the spawn is deposited in ponds and other stagnant waters in large masses, of gelatinous matter. These masses, with black globules scattered through them, soon manifest change, and after a time the young escapes as a tadpole, as an animal with short body, circular suctional mouth, and long tail, compressed from side to side. Gills project on either side of the head from a cleft which answers in position to the gill opening of fishes. The hind limbs first appear as buds, later the ore limbs project, the gills disappear, the lungs becoming more fully developed; the tail gradually shrinks and disappears, and the animal, which was at first fish-like, then closely resembled a newt (or tailed Amphibian), finally assumes the adult or tailless form. The mature frog breathes by lungs, and cannot exist in water without coming to the surface for air. The only British species is the common frog, but the tribe is very numerous, other varieties being the edible frog of the south of Europe, eaten in France and south Germany, the hind quarters being the part chiefly used; the bull-frog of America, 8 to 12 inches long, so named from its voice resembling the lowing of a bull; the blacksmith frog of Janeiro; the Argus frog of America, etc. Frogs swim with rapidity, and move by long bounds, being able from the power of the muscles of their hind-legs to leap many times their own length.

FROH'MAN, Charles, American theatrical manager, was born in Sandusky, Ohio, in 1858. After having become an independent manager of various companies "on the road," he established himself in 1893 at the Empire Theater, New York, and in the season of 1895–96 formed with several managerial firms the "syndicate," which has gradually strengthened its position till in many parts of the country it has a practical monopoly of playhouses. He has brought out as stars Maude Adams, Julia Marlowe, John Drew, and other well-known actors.

FROHMAN, Daniel, American theatrical manager, born in Sandusky, Ohio, in 1853. He has managed the Fifth Avenue, Madison Square, the Lyceum and Daly's Theaters, besides the Daniel Frohman Stock Company and various special attractions.

FROISSART (frwå-sår), Jean, a French poet and historian, was born in 1337 at Valenciennes, died in Flanders between 1400 and 1410. At the age of eighteen he went to England, where, having already the reputation of being a gay poet and narrator of chivalric deeds, he was received with great favor, Philippa of Hainault, wife of Edward III., declaring herself his patroness.

FRONDE (frond), a French party during the minority of Louis XIV., which waged civil war against the court party on account of the heavy fiscal impositions laid on the people by Cardinal Mazarin, whom the queen-mother had appointed prime-minister after the decease of Louis XIII. (1648). At the head of the Fronde stood the Cardinal de Retz, and latterly the Prince Louis Condé. The result of this contest, which lasted from 1648 to 1654, served only to strengthen the royal power. The name is from Fr. Fronde, "a sling," a member of the parliament having likened the party to boys slinging stones in the streets, but who dispersed on the appearance of the authorities.

FROST, the name we give to the state of the weather when the temperature is below the freezing-point of water (32° F.). The intensity of the cold in frost is conveniently indicated by the popular expression so many degrees of frost, which means that the temperature of the atmosphere is so many degrees below the point at which the freezing of water commences. Frost is often very destructive to vegetation, owing to the fact that water, which is generally the chief constituent of the juices of plants, expands when freezing, and bursts, and thus destroys, the vesicles of the plant. In the same way rain-water, freezing in the crevices of rocks, breaks up their surfaces, and often detaches large fragments. Hoar-frost is frozen dew. It may either freeze while it is falling, when it is found loosely scattered on the ground; or being deposited as dew in the early part of the night it may freeze during a subsequent part of it, owing to radiation. It is generally seen most profusely in spring and autumn; because at those times, while on clear nights the cold is sufficient to freeze the dew, the days are at the same time sufficiently warm to cause a very considerable quantity of moisture to evaporate into the air.

FROST-BITE, a condition caused by the action of frost on the human economy. It is generally local and partial, varying from ordinary chilblain to complete death of the part frozen. The simplest treatment consists in coaxing back the vitality of the part affected by means of friction.

FROSTED-GLASS, glass roughened on the surface, so as to destroy its tranparency, in consequence of which the surface has somewhat the appearance of hoar-frost.—The term frosted is also applied to the dead or lusterless appearance of gold and silver jewelry when polishing the surface is omitted.

FROUDE (frŏd), James Anthony, historian and miscellaneous writer, born at Totness, Devonshire, 1818. He was educated at Oxford, was elected fellow of Exeter College, and received deacon's orders. He resigned his fellowship and withdrew from orders on the publication of his Nemesis of Faith, 1848. Between the years 1856 and 1869 appeared his great work The History of England from the Fall of Wolsey to the Defeat of the Spanish Armada, which was very popular, though it received but doubtful approval from historians. He was made literary executor to Carlyle, and his Life of Carlyle, and Carlyle's Reminiscences, and Letters and Memorials of Jane Welsh Carlyle, as edited by him, provoked an extraordinary amount of interest and controversy. Among his other works are Short Studies on Great Subjects; English in Ireland in the Eighteenth Century; Julius Cæsar Oceana, or England and her Colonies The English in the West Indies, etc. He died in 1894.

FRUIT, in botany, the seed of a plant or the mature ovary, composed essentially of two parts, the pericarp and the seed. In a more general sense the term is applied to the edible succulent product of certain plants, generally covering an including their seeds.

FU-CHOW. See Foo-chow.

FUCHSIA (fu'shi-a), a genus of beautiful flowering shrubs, natives of South America, Mexico, and New Zealand nat. order Onagraceæ, characterized by having a funnel-shaped, colored, deciduous, four-parted calyx, sometimes with a very long tube; four petals set

the mouth of the calyx-tube and alternating with its segments; eight exserted stamens, and a long style with a capitate stigma. This is one of our most common decorative greenhouse plants, while the hardy varieties out of doors in the open border form an important feature with their drooping elegant habit and their wonderful profusion of flowers.

FUEL, carbonaceous matter, which may be in the solid, the liquid, or the gaseous condition, and which, in combining with oxygen, gives rise to the phenomenon of heat, the heat being made use for domestic, manufacturing, or other purposes. The most important of the gaseous fuels is common coal-gas, which is now commonly applied for the heating of rooms by means of gas-fires and gas-stoves. For such purposes the coal-gas should be mixed with air just below the point at which it is burned. It then gives a blue, hot, and smokeless flame. A gas-fire may be obtained in an ordinary grate by filling it with asbestos, which is heated to incandescence by gas properly applied. Gas-stoves of various constructions are also used for heating apartments, cooking, etc. Another gaseous fuel now coming into use for industrial purposes is water-gas, obtained by the decomposition of water. The principal liquid fuels are petroleum, shale-oil, creosote, the various animal and vegetable oils, and alcohol. It is only the mineral oils that are used to any great extent for producing heat. Alcohol is only employed in operations requiring the application of a small volume of heat, and in such it is as convenient and manageable a fuel as can be desired. Successful attempts have been made in recent times to discover methods by which liquid fuel, and more especially petroleum, may be applied to the heating of steam-boilers. In some of the systems it is the combustion of the oil itself, supplied in the form of spray, that produces the heat; in others the oil is volatilized by means of superheated steam, and the gas is burned in the furnace from ordinary pipes as in a gas-stove. The heating power of petroleum is considerably greater than that of coal, and in a ship, for instance, it would occupy less space, while the laborious process of stoking would be dispensed with. Creasote has been successfully employed as fuel in the process of armor-plate bending. Peat is used as a domestic fuel in many places, but, compared with the more solid fuels, it is unfit to be employed for producing very strong heats. An improvement in the use of it as a fuel, however, has been introduced by employing a process of compression, which gives it almost the solidity of coal. It is also sometimes soaked in oil or tar, and then used in the form of bricks. Wood, is in some countries almost the only sort of fuel to be had. In France, Germany, etc., it is extensively used in metallurgy as well as for domestic purposes. Before it is suited for making satisfactory fuel, wood must be dried for a considerable time either in the open air or under cover, but the latter method is better, as little or no decomposition of the wood goes on. Woods that have a close and compact texture, such as the oak, beech, or elm, burn much more slowly and with less flame than soft woods like the lime, horse-chestnut, or pine; the latter are consequently preferred as fuel for some purposes. Coal, as is well known, is of vegetable origin, and this is clearly seen in that variety of it known as lignite, which still retains its woody structure, even to the eye. Wood charcoal is another kind of fuel which is extensively used in metallurgy, chemistry, and in various industrial arts. It kindles quickly, emits few watery or other vapors while burning, and, when consumed, leaves few ashes, and those very light. They are, therefore, easily blown away, so that the fire continues open, or pervious to the current of air which must pass through it to keep it burning. This sort of fuel, too, is capable of producing as intense a heat as can be obtained by any; but in violent heats it is quickly consumed, and needs to be frequently supplied. Coke or pit-coal charred is a fuel which possesses in many respects the same properties as charcoal of wood. It is employed for producing intense melting heats. Various kinds of artificial fuel are manufactured. These are composed of different ingredients, of which coal slack or dust is the most important. The coal-dust is mixed with some adhesive substance, such as clay, lime, coal-tar, etc., and compressed into bricks. Slack-coal has also been employed as fuel in an entirely different mode. It is ground as fine as possible, and blown into the furnace, where it burns much in the same way as the spray of liquid fuel.

FUGITIVE SLAVE LAWS, the surrender of escaped slaves and criminals was authorized by a law passed in 1793 under a clause in article 4 of the United States constitution. The compromise of 1850 provided a new and more stringent law under which a marshal was liable to a fine for a refusal to execute writs under the act, and he was made liable for the value of a slave escaping from his custody. The testimony of the person claimed to be a slave was not to be considered. The commissioner was given a fee of $10 if the prisoner were adjudged a slave but only $5 were he declared free. Under this law the kidnaping of free negroes in the north became frequent and many cases of cruelty occurred. The law met with little support in the north, many of the states enacting legislation which rendered it nugatory and the south of course regarded this as a breach of faith. The fugitive slave laws were repealed in 1864.

FUGUE (fūg), a musical term derived from the Latin word fuga (a flight), and signifying a polyphonic composition constructed on one or more short subjects or themes, which are harmonized according to the laws of counterpoint, and introduced from time to time with various contrapuntal devices, the interest in these frequently-heard themes being sustained by diminishing the interval of time at which they follow each other, and monotony being avoided by the occasional use of episodes, or passages open to free treatment.

FUJI-YAMA or **FUSI-YAMA,** a dormant volcano of a symmetrical cone-like shape, in the island of Hondo, Japan, the sacred mountain of the Japanese. It has been quiescent since 1707; is 12,400 feet in height, and is visible in clear weather for a distance of nearly a hundred miles.

FULCRUM, in mechanics, the support or fixed point about which a lever turns. See Lever.

FUL'GURITE, any rocky substance which has been fused or vitrified by lightning. More strictly a vitrified tube of sand formed by the intense heat of lightning penetrating the sand, and fusing a portion of the materials through which it passes.

FULHAM (ful'am), one of the London mun. and parl. boroughs, bounded by the Thames, and the boroughs of Chelsea, Kensington, and Hammersmith. It contains the palace of the Bishop of London, and returns one member to parliament. Pop. of mun. bor. 137,289.

FULLER, George, American figure, portrait, and landscape painter, was born at Deerfield, Mass., in 1822. He spent several years in Boston, portrait painting, then removed to New York, and continued his studies at the academy. He was elected associate of the National academy in 1857. He went south for three years, making many studies of negro life. In 1860 he went to Europe. His later works show his keen appreciation of nature. In 1876 he exhibited fourteen pictures in Boston which were received with enthusiasm. This was followed by frequent exhibitions at the Academy. In 1879 Mr. Fuller showed the Romany Girl, and She Was a Witch. In 1880, the Quadroon, and in 1881, the loveliest of all his works—the "Winifred Dysart." "Turkey Pasture in Kentucky" is one of his finest examples. He died in 1884.

FULLER, Melville Weston, American jurist, a chief justice of the supreme court of the U. States, was born in Augusta, Me., in 1833. In 1856 he established himself at Chicago, Ill., where he continued to practice law until 1888. He was a member of the Illinois state constitutional convention of 1862, and in 1863 sat in the lower house of the Illinois legislature. In 1888 he was appointed by President Cleveland chief justice of the U. States supreme court, to succeed M. R. Waite, deceased. His term witnessed an expansion of the federal powers by means of the decision asserting the implied authority of the executive to protect the federal judges on occasions when there is just reason to believe that, while in the exercise of official duties, they are exposed to personal danger. In 1899 he was a member of the arbitration commission convened at Paris for the adjustment of the Anglo-Venezuelan boundary question.

FULLER, Sarah Margaret (Ossoli), American critic and essayist, born at Cambridgeport, Mass., in 1810. She conducted the transcendental organ, The Dial (1840–42), made translations from the German, and published in 1844 her first volume, Summer on the Lakes, the record of a season of travel in 1843. In December (1844) she went to New York as literary critic of the Tribune, taking active part in the philanthropic, literary and artistic life of the

city. In 1846 she went to Europe, where she was received by social, political and literary leaders, residing for some time at Rome, where she married (December, 1847) Giovanni Angelo, Marquis d' Ossoli, by whom she had one child. She took an active part in the Italian struggle for independence, and served heroically in the hospitals during the French siege of Rome. On its capture (July 1849) she took refuge with her husband first in the mountains of Abruzzi, then at Florence, and on May 17, 1850, sailed for America. The voyage was most disastrous, The captain died of smallpox, her son was taken with the disease, and she and her husband and son were drowned off Fire Island Beach just as they were approaching New York on July 16.

FULLER'S EARTH, a variety of clay or marl, compact but friable, unctuous to the touch, and of various colors, usually with a shade of green. It is useful in scouring and cleansing cloth, as it imbibes the grease and oil used in preparing wool. It consists of silica 50 per cent, alumina 20, water 24, and small quantities of magnesia, lime, and peroxide of iron. There are very extensive beds of this earth in several counties in England.

FULLING-MILL, a mill for fulling cloth by means of pestles or stampers, which beat and press it to a close or compact state, and cleanse it. The principal parts of a fulling-mill are the wheel, with its trundle, which gives motion to the tree or spindle, whose teeth communicate that motion to the pestles or stampers, which fall into troughs, wherein the cloth is put, with fuller's-earth, to be scoured and thickened by this process of beating.

FULMAR, a natatorial or swimming oceanic bird about the size of a large duck. It inhabits the northern seas in prodigious numbers, breeding in Iceland Greenland, Spitzbergen, the Shetland and Orkney Islands, the Hebrides, etc. It feeds on fish, the blubber of whales,

Fulmar.

and any fat, putrid, floating substance that comes in its way. It makes its nest on sea-cliffs, in which it lays only one egg. The natives of St. Kilda value the eggs above those of any other bird. The fulmar is also valued for its feathers and down, and for the oil found in its stomach, which is one of the principal products of St. Kilda. When caught or assailed it lightens itself by disgorging the oil from its stomach. There is another and larger species found in the Pacific Ocean.

FULMINATION, a term used in chemistry to denote the sudden decomposition of a body by heat or percussion accompanied by a flash of light and a loud report. Fulminating compounds, or fulminates, are explosive compounds of fulminic acid with various bases, such as gold, mercury, platinum, and silver. The old fulminating powder is a mixture of sulphur, nitre, and potash. Fulminate of mercury forms the priming of percussion-caps.

FULMINIC ACID, a peculiar acid known only in combination with certain bases, and first discovered along with mercury and silver, with which it forms powerfully detonating compounds.

FULTON, Robert, an American engineer, the introducer of steam navigation on American waters, was born in Pennsylvania in 1765, died 1815. In his twenty-second year he went to England and became acquainted with the Duke of Bridgewater, Earl Stanhope, and James

Watt, and was led to devote himself to mechanical engineering. In 1794 he took a patent for a double inclined plane, which was intended to supersede locks on canals; and he also patented a mill for sawing marble, machines for spinning flax and making ropes, a dredging-machine, etc. In 1797 he went to Paris, where he produced the first panorama that was exhibited there. He also, after some trials, was successful in introducing a boat propelled by steam upon the Seine. During a visit to Scotland he had seen and obtained drawings of the Charlotte Dundas, a steam-vessel which had plied with success on the Forth and Clyde Canal. His chief occupation in Paris, however, was the invention of torpedoes for naval warfare. He returned to America in 1806, and built a steam-boat of considerable dimensions, which began to navigate the Hudson river in 1807. Its progress through the water was at the rate of 5 miles an hour. In 1814 he constructed the first war steamship, and was engaged upon an improvement of his submarine torpedo when he died.

FUNCTION, in math. a quantity so connected with another that no change can be made in the latter without producing a corresponding change in the former, in which case the dependent quantity is said to be a function of the other; thus, the circumference of a circle is a function of the diameter; the area of a triangle is a function of any two of the sides and the angle they contain. In order to indicate in a general way that one quantity y is a function of another x the notation $y = f(x)$, or something similar, is adopted; thus, if u be the area of a triangle, x and y two of the sides, and θ the contained angle, we should write $u = \phi(x, y, \theta)$.

FUNCTION, the specific office or action which any organ or system of organs is fitted to perform in the animal or vegetable economy.—Vital functions, functions immediately necessary to life, as those of the brain, heart, lungs, etc.—Natural or vegetative functions, functions less instantly necessary to life, as digestion, absorption, assimilation, expulsion, etc.—Animal functions, those which relate to the external world, as the senses, voluntary motions, etc.

FUNDAMENTAL NOTE, in music, the lowest or gravest note that a string or pipe can sound.—Fundamental tones are the tones from which harmonies are generated.

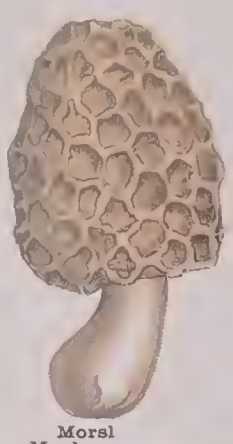
FUNDS AND FUNDING, money or other form of wealth accumulated and devoted to, or available for, some special purpose or enterprise. In Great Britain the securities issued for the national debt are known as the public funds, or simply as the funds. The process of funding a debt consists in dividing it into parts or shares (bonds) with stated times of payment of interest and principal, the latter usually at a remote date. The substitution of bonds of lower rate for those of higher rate is often called refunding; provision, made by agreement, from year to year, for the payment of the principal is known as a sinking fund Funded debt is opposed to floating debt, which consists of notes and overdue bills and to current debt, which consists of bills and other adverse balances already incurred but not yet overdue.

FUNDY, Bay of, a large inlet of the Atlantic, on the east coast of North America, separating Nova Scotia from New Brunswick. It is noted for its impetuous tides, which cause a rise and fall of from 12 to 70 feet, and the navigation is dangerous. A ship-railway is being constructed to connect Chignecto Bay with Northumberland Strait.

FU'NEN, the largest of the Danish islands except Seeland, from which it is separated by the Great Belt, and from Jutland by the Little Belt; circuit, about 185 miles; area, 1132 sq. miles. The chief towns are Odense, Svendborg, and Nyborg. The population is 279,501.

FUNERAL RITES, the rites and ceremonies connected with the disposing of the dead. Among the ancient Egyptians the friends af the deceased put on mourning habits, and abstained from gaiety and entertainments for from forty to seventy days, during which time the body was embalmed. Among the ancient Jews great regard was paid to a due performance of the rites of sepulture; and among the ancient Greeks and Romans to be deprived of the proper rites was considered the greatest misfortune that could happen. The decorus interring of the dead with religious ceremonies indicative of hopes of a resurrection is characteristic of all Christian

Horse Tail
Mushroom.



Morsl
Mushroom.

Clavaria
Cinsrsa.

Champignon
(Agaricus Campsstris).

Common Fisld
Mushroom.

Fairy Ring
Mushroom.

Horss
Mushroom.

EDIBLE FUNGI.

Russula emstica.

(Lactarius torminosus.)

(Bolstus luridus.)

POISONOUS FUNGI.

FUNGI.

nations. With Roman Catholics the body is the object of solemn ceremonial from the moment of death until interment. The Church of England funeral service is too well known to require any notice. Among other Protestant bodies there is usually no formal service, but prayer is offered up or an ordinary religious service held before the interment in the house of the deceased or his relatives, or, in the case of a public funeral, in some public place. The practice of delivering funeral orations at the interment of the dead by laymen is common in France, and not unfrequent in America. The wake, or watching, is celebrated in some parts of the world particularly in its remoter districts.

FUNFKIRCHEN, a town of the Austrian Empire, in Hungary, on the slope of a hill, 105 miles s.s.w. Budapest. Pop. 43,982.

FUNGI (fun'jī), a large natural order of cryptogamous or flowerless plants, comprehending not only the various races of mushrooms, toad-stools, and similar plants, but a large number of microscopic plants growing upon other plants, and substances which are known as moulds, wildew, smut, rust, brand, dry-rot, etc. Fungi agree with algæ and lichens in their cellular structure, which is, with very few exceptions, void of anything resembling vascular tissue; but differ from them in deriving their nutriment from the body on which they grow, not from the medium by which they are surrounded. They are among the lowest forms of vegetable life, and, from the readiness with which they spring up in certain conditions, their germs are supposed to be floating in the atmosphere in incalculable numbers. Some diseases are produced by fungi. Fungi differ from other plants in being nitrogenous in composition, and in inhaling oxygen and giving out carbonic acid gas. Berkeley divides fungi into two great sections, the first having the spores naked, and comprising agarics, boleti, puff-balls, rust, smut, and mildew; the second comprising the murels, truffles, certain moulds, etc., in which the spores are in sacs. These are again subdivided into six principal orders, all formed on the mode in which the spores are borne. Fungi occur in every part of the earth where the cold is not too intense to destroy the spawn, though they abound most in moist temperate regions where the summer is warm. Several species afford excellent and abundant food, others are valuable in medicine, while many are among the greatest pests of the cultivator.

FUNK, Isaac Kauffman, American clergyman, publisher and editor, born at Clifton, Ohio, 1839. Pastor of St. Matthew's English Lutheran church in Brooklyn for seven years. Founder of the Literary Digest (1889), Standard Dictionary (1895), and Jewish Encyclopedia (1901).

FUNNEL, the shaft or hollow channel of a chimney through which smoke ascends; especially in steam-ships, a cylindrical iron chimney for the boiler-furnaces rising above the deck.

FUNNY BONE, the ulnar nerve is so slightly protected in the groove where it passes behind the internal condyle of the humerus that it is often affected by blows on that part. A peculiar electric thrill passes along the arm to the fingers whenever the nerve is struck or pressed.

FUNSTON, Frederick, American soldier, was born in Newcarlisle, Ohio, in 1865. He distinguished himself as a soldier in the war for the independence of Cuba, rising after many wounds in the insurgent army, to the rank of lieutenant-colonel. At the outbreak of the Spanish American war he organized the 20th Kansas volunteers of whom he became colonel. Fighting in the Philippines his bravery at Calumpit won him a commission as brigadier-general of volunteers. March 23, 1901, he captured Aguinaldo the Filipino insurgent leader and as a reward was commissioned brigadier-general U. S. A.

FUR, is the fine soft hairy covering of certain animals, especially the winter covering of animals belonging to northern latitudes. The term fur is sometimes distinctively applied to such coverings when prepared for being made into articles of dress, etc., while the name of peltry is given to them in an unprepared state or when merely dried. The animals chiefly sought after for the sake of their furs are the beaver, raccoon, musk-rat, squirrel, hare, rabbit, the chinchilla, bear (black, gray, and brown) otter, sea-otter, seal, wolf, wolverine or glutton, marten, ermine, lynx, coypou (nutria), polecat (fitch), opossum, fox, etc. (See under proper headings.) All the preparation that skins require before being sent to the market is to make them perfectly dry, so as to prevent them from putrefying. This is done by exposing them to the heat of the sun or a fire. The small skins are sometimes previously steeped in a solution of alum. When stored in large quantities they must be carefully preserved from dampness, as well as from moths. The fur-dresser, on receiving the skins, first subjects them to a softening process. He next cleans them from loose pieces of the integument by scraping them with an iron blade. Finally, the fur is cleaned and combed, after which it is handed over to the cutter, who cuts the furs out into the various shapes required to make different articles.

The principal North American fur-bearing animals are beaver, muskrat, hare, and squirrel; the mink, sable, fisher, ermine, weasel, raccoon, badger, and skunk; the lynx, northern and southern bears of several kinds; foxes of three or four varieties; two wolves; and most valuable of all, musk-ox, seal and sea-otter. Of foreign fur-bearing animals the most highly prized are the chinchilla, coypu (nutria), and various monkeys, marsupials (opossum, kangaroo, etc.), and cats.

FURIES, Eumenides, Erinnyes (among the Romans, Furiæ and Diræ), deities in the Greek mythology, who were the avengers of murder, perjury, and filial ingratitude. Later mythologists reckon three of them, and call them Alecto, Megæra, and Tisiphone. Æschylus, in his celebrated tragedy of the Eumenides, introduced fifty furies, and with them Fear and Horror, upon the stage. They were regarded with great dread, and the Athenians hardly dared to speak their names, but called them the venerable goddesses. It was by a similar euphemism the name Eumenides, signifying the toothed or well-pleased goddesses, was introduced. Erinnyes, the more ancient signifies the hunters or persecutors of the criminal, or the angry goddesses.

FURLONG, a measure of length, 40 rods, roles, or perches, equal to 220 yards, the eighth part of a mile.

FURLOUGH (fêr'lō), a military term signifying leave of absence given by the commanding officer to an officer or soldier under his command.

FURNACE, a place where a vehement fire and heat may be made and maintained, as for melting ores or metals, heating the boiler of a steam-engine, warming a house, baking pottery or bread, and other such purposes. Furnaces are constructed in a great variety of ways, according to the different purposes to which they are applied. In constructing furnaces the following objects are kept in view: (1) To obtain the greatest quantity of heat from a given quantity of fuel. (2) To prevent the dissipation of the heat after it is produced. (3) To concentrate the heat and direct it as much as possible to the substances to be acted upon. (4) To be able to regulate at pleasure the necessary degree of heat and have it wholly under the operator's management. An air-furnace is one in which the flames are urged only by the natural draft; a blast-furnace, one in which the heat is intensified by the injection of a strong-current of air by artificial means; a reverberatory furnace, one in which the flames in passing to the chimney are thrown down by a low-arched roof upon the objects which it is intended to expose to their action.

FURNEAUX ISLANDS (fêr'nō), a group belonging to Tasmania, at the east end of Bass Strait, including Flinders Island with an area of 513,000 acres; Cape Barren Island, 110,000 acres, and Clarke Island, 20,000 acres. The inhabitants, who number about 620, many of them "half-castes," procure a living by seal-fishing and preserving mutton-birds, a species of petrel.

FUR'NESS, Horace Howard, American Shakespearean scholar, was born in Philadelphia in 1833. His Variorum Shakespeare issued in thirteen volumes, 1871–1891 is everywhere received as a monument of scholarship. Associated with him in his work was his wife, herself author of a concordance to Shakespeare's poems and his son Horace Howard Furness, Jr.

FUR-SEAL, a name given to several of the Otariidæ or "cared" seals which have a dense covering of fine under fur. The best known and most valuable is the fur-seal or sea-bear of some of the islands connected with Alaska, especially St. Paul's and St. George's, where it breeds.

FURTH (fürt), a town in Bavaria, 6 miles w.n.w. of Nürnberg, at the confluence of the Pegnitz with the Rednitz. Pop. 54,820.

FURZE, the common furze is a low shrubby plant, very hardy, and very abundant in barren, heathy, sandy, and gravelly soils throughout the west of Europe. The stem is generally 2 or 3 feet high, much branched and most of

the leaves converted into spines. The flowers are solitary and yellow. It often covers exclusively large tracts of country, and makes a splendid appearance when in flower. It is used as fuel, and sometimes the tops of the branches are used (especially the young tops) as fodder for horses and cattle, after having been beaten or bruised to soften the prickles.

FUSE, a tube filled with combustible matter, used in blasting, or in discharging hollow projectiles, etc. There are many varieties in use, such as the fuse used in mining and quarrying, which usually consists of a tube filled with a slow-burning composition, which gradually burns down to the charge; the concussion and percussion fuses for hollow projectiles, which explode the charge when an object is struck; the electric fuse, which is ignited by the passage of an electric spark through it; and time or mechanical fuses, used in some forms of torpedo, and with such explosives as dynamite and gun-cotton.

FUSEE', the cone or conical part of a watch or clock, round which is wound the chain or cord. It is a mechanical contrivance for equalizing the power of the mainspring; for as the action of a spring varies with its degree of tension,

Barrel and fusee of a watch.

the power derived from the force of a spring requires to be modified according to circumstances before it can become a proper substitute for a uniform power. In order, therefore, to correct this irregular action of the mainspring, the fusee on which the chain or catgut acts is made somewhat conical, so that its radius at every point may be adapted to the strength of the spring.

FUSEL-OIL, a heavy oily inflammable fluid with a high boiling-point, disagreeable cutting odor, and pungent taste, which is separated in the rectification of ordinary spirit distilled from grain, malt, potatoes, molasses, beetroot, etc. The composition of this fluid depends on the materials used in the manufacture of the spirit, but it may be said to consist to a large extent of ethylic and amylic alcohol. Fusel-oil acts very deleteriously on the animal system, and this is the reason why inferior spirits are so injurious in their effects.

FUSIBLE METAL, an alloy, usually of lead, tin, and bismuth, compounded in such definite proportions as to melt at a given low temperature. In steam-engines, a plug of fusible metal is placed in the skin of the boiler, so as to melt and allow the steam to escape when a dangerous heat is reached.

FUSIBLE PORCELAIN, a silicate of alumina and soda obtained from cryolite and sand, fused and worked as glass.

FUSILIERS, formerly soldiers armed with a fusil or light flint-lock musket closely resembling a carbine. The name is given to nine or ten regiments in the British army, which differ from other regiments of the line chiefly in the busby worn by officers and non-commissioned officers.

FUSING-POINT, the degree of temperature at which a substance melts or liquefies. This point is very different for different metals. Thus potassium fuses at 136° Fahr., bismuth at 504°, lead at 619°, zinc at 680°, silver 1832°, gold 2282°. Malleable iron requires the highest heat of a smith's forge (2912°); while cerium, platinum, and some other metals are infusible in the heat of a smith's forge, but are fusible before the oxy-hydrogen blow-pipe. See Freezing, Fusing and Boiling Points.

FUSION, the conversion of a solid body into the liquid state by direct heat, as distinguished from solution, in which the effect is produced by means of a liquid. It is difficult, however, to draw a line between the two, for the main difference is in the temperature, and when a flux is employed all distinction disappears. The term is specially applied to the action of heat on the metals, but it is extended to any solid matter; thus the passage of ice into water at 32° F. is true fusion. There are bodies like carbon, lime, magnesia, zirconia, and other metallic oxides, which are practically, if not absolutely, infusible. See Fusing-point.

FUST, Johann, a goldsmith of Mainz, associated with Gutenberg and Schöffer in connection with the origin of printing. He probably died of the plague in 1466. See Printing.

FUSTIAN, a cotton or mixed linen and cotton fabric with a pile like that of velvet but shorter. It includes corduroy, moleskin, velveteen, etc.

FUSTIC, the wood of a tree of the mulberry order growing in the West Indies. It is a large and handsome tree, and the timber, though, like most other dyewoods, brittle, or at least easily splintered, is hard and strong. It is extensively used as an ingredient in the dyeing of yellow, and is largely imported for that purpose.—Young Fustic is the wood of the Venice sumach, a south European shrub with smooth leaves and a remarkable feathery inflorescence. It yields a fine orange color, which, however, is not durable without a mordant.

FYZABAD, or FAIZABAD, a town in British India. Pop., including cantonments, in 1901, 75,085.

G

G, the seventh letter in the English alphabet. English g hard is a gutteral mute, the "voiced" or soft or sonant sound corresponding to the "breathed" or hard or surd sound k (or c hard). This sound of g is what the letter always has before a (except in gaol), o, u, and when initial also before e and i in all words of English origin, and when final. The soft sound of g, or that which it more commonly has before e, i, and y, as in gem, gin, gymnastics, is a palatal sound the same as that of j, and did not occur in the oldest English or Anglo-Saxon.

G, in music, (a) the fifth note, and dominant of the normal scale of C, called also sol; (b) the lowest note of the grave hexachord; in the Guidonian system gamma ut; (c) a name of the treble clef, which is seated on the G or second line of the treble staff, and which formerly had the form of G.

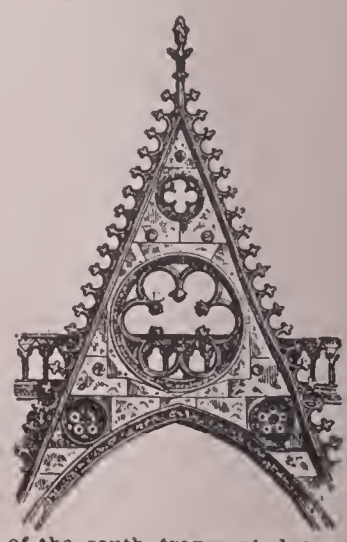
GA'BION, a large wickerwork basket of cylindrical form, but without bottom. In a siege, when forming a trench, a row of gabions is placed on the outside nearest the fortress, and filled with earth as it is thrown from the trench, so as to form a protection against the fire of the besieged. Each gabion is about 20 inches in diameter and 33 inches in

Part of trench with gabions and fascines.

height, but this height is usually increased by placing a row of fascines on the top after the interior has been filled up.

GABLE, the triangular end of a house, or other building, from the eaves to the top; gable door, a door pointed at top like a gable.

GABORIAU, Emile, a French novelist, born 1834, died in Paris 1873. After



Gable of the south transcept door of Notre Dame, Paris; 13th century.

contributing to the smaller Parisian journals short sketches he achieved a

considerable success by his novel Dossier No 113 (1866). He continued to work this vein in a series of clever stories dealing with crime and its detection: Le Crime d'Orcival, L'Affaire Lerouge, Les Esclaves de Paris, La Vie Infernale, La Corde au Cou, L'Argent des Autres, etc.

GAB'RIEL ("hero or man of God"), according to Biblical history, the angel who announced to Zacharias the birth of John, and to Mary the birth of the Savior. In Jewish mythology he is one of the seven archangels. The rabbins say he is the angel of death for the Israelites, and according to the Talmud he is a prince of fire, who presides over thunder and the ripening of fruits. In Mohammedan theology he is one of the four angels employed in writing the divine decrees, and the angel of revelation, in which capacity he dictated the Koran to Mohammed.

GAD ("a troop"), one of the twelve tribes of Israel, which took its name from Gad, the son of Jacob and Zillah. At the time of the exodus the tribe numbered 45,650 men of twenty years old and upwards; and as being a pastoral tribe they were assigned a rich district in Gilead between Reuben and Manasseh. See Josh. xiii. 24–28.

GADFLY, a name commonly applied to various insects, is about 7 lines in length; thorax yellow, with a black band; abdomen white; terminal segments fulvous; wings dusky. This

Gadfly, natural size.

species attacks the horse also, the female depositing her eggs in the skin of these animals in considerable numbers. In a short time the eggs are matured, and produce a larva or worm, which immediately pierces the skin, raising large lumps or tumors filled with pus, upon which the larva feeds. It deposits its eggs upon such parts of the skin of horses as are subject to be much licked by the animal, and thus they are conveyed to the stomach, where the heat speedily hatches the larvæ, too well known under the name of botts. Another species deposits its eggs in the nostrils of sheep, where the larva is hatched, and immediately ascends into the frontal sinuses, attaching itself very firmly to the lining membrance by means of two strong hooks situated at its mouth. Other species infest the buffalo, camel, stag, etc. Even rhinoceroses and elephants are said not to be altogether exempt from their attacks. The characteristics of the genus are two enormous eyes, usually of a greenish-yellow colored, rayed or spotted with purple, antennæ scarcely longer than the head, the last joint with five divisions. These insects suck the blood of horned cattle, horses, and sometimes even of men.

GAD'OLINITE, a mineral, a silicate of yttrium, with a considerable proportion of lime and magnesia, of the oxides of iron, cerium, lanthanum, glucinum, and sometimes of other bases It is usually found in dull, amorphous masses disseminated through granite; is black, or very dark green, with a resinous luster. It was named after the mineralogist Gadolin, professor at Abo, 1785–1822.

GADSDEN, Christopher, American patriot; was born in Charleston, S. C., in 1724. He was, in 1765, elected a delegate to the Intercolonial convention held in New York City to protest against the stamp act. In 1774 he was a member of the first Continental congress in Philadelphia. In 1778 he was a member of the State Constitutional convention of South Carolina. Elected lieutenant-governor of the state, he signed the capitulation of Charleston when that city fell into the hands of Sir Henry Clinton, in May, 1780. In 1782 he was elected governor of South Carolina, but refused to accept the office, pleading that he was too old. He died in 1805.

GADSDEN, James, American soldier and diplomatist, born in Charleston, S. C., in 1788. He served with marked efficiency in the War of 1812, was appointed aide-de-camp to General Jackson in 1818, participated in the Seminole war, was appointed military inspector of the southern division in 1820, and subsequently conducted the removal of the Seminole Indians to the southern part of Florida. In 1853 he was sent to Mexico as U. States minister, and in December of that year concluded the treaty which provided for the readjustment of the boundary between the two counties, and the acquisition by the U. States of the tract of land subsequently known as the "Gadsden purchase."

GADSDEN PURCHASE, the, tract of land lying partly within the present New Mexico and partly within the present Arizona, purchased from Mexico by the U. States in 1874. It embraces 45,535 sq. miles, is bounded on the north by the Gila river, on the east by the Rio Grande, and on the west by the Colorado and has an extreme breadth from north to south of 120 miles. For this the U. States gave the sum of $10,000,000, while Mexico, besides making the cession, agreed (1) to the abrogation of the eleventh article of the treaty of Guadalupé Hidalgo (q. v.), and (2) to the abandonment of all damage claims arising from Indian incursions between 1848 and 1853. The land was regarded as of little use for agricultural purposes, and was purchased largely with a view to settling boundary disputes in that quarter between the two governments and to secure a desirable route for the projected Southern pacific railroad. The treaty of sale was negotiated with Santa Anna by James Gadsden (q.v.), then minister to Mexico, in December, 1853, and, after undergoing modifications in the U. States senate, was finally ratified and proclaimed on June 30, 1854, congress passing the necessary legislation on August 5th. The sale met with much opposition in Mexico, and caused the banishment of Santa Anna in 1855.

GADWALL', the common name of a species of duck not so large as the mallard, with long pointed wings and a vigorous and rapid flight. North America as far down as South Carolina is its favorite habitat.

GAEL (gāl), the name of a branch of the Celts inhabiting the Highlands of Scotland, Ireland, and the Isle of Man. Gadhel or Gael is the only name by which those who speak ihe Gaelic language are known to themselves. By way of distinction the Highlanders of Scotland call themselves Gael Albinnich (Gaels of Albin) and the Celtic population of Ireland call themselves Gael Erinnich (Gaels of Erin).

Gaelic is the name now generally restricted to that dialect of the Celtic language which is spoken in the Highlands of Scotlands, and hence distinguished from Manx and Irish, the other two kindred dialects, which scholars of the present day include under the name (or rather spelling) Gaedhelic. The modern Gaelic differs to some extent from the Irish in pronunciation, in grammar, in idioms, and in vocabulary. The literature of the Gaelic language is somewhat scanty, and is much less ancient and important than the Irish. The earliest written specimens of Gaelic are scraps contained in the Book of Deer, a religious manual belonging to the early part of the 12th century. To the 14th and 15th centuries a considerable number of pieces belong. A collection of the older poetry, ascribed to Ossian and others, was made in the first half of the 16th century by Sir James Macgregor, dean of Lismore—hence called "The Dean of Lismore's Book." Robert Calder Mackay, or Robb Donn, and Duncan Ban M'Intyre, of Glenorchy, are the two most noteworthy poets among the Scottish Highlanders in modern times. They both belong to the 18th century. This century also saw the publication of the Bible in Gaelic, the Irish Bible having been previously well known in the Highlands. The so-called poems of Ossian appeared about the same time, but in English, and it was not till 1818 that the corresponding Gaelic text appeared. A series of tales and legends of the Highlands of Scotland have been collected and published by J. F. Campbell. Various English works have been translated into Gaelic, and several collections of Gaelic poetry were published in the 19th century, as well as Gaelic periodicals. Gaelic poetry still continues to be written not only in Scotland but even in America.

GAFF, a spar used in ships to extend the upper edge of fore-and-aft sail which are not set on stays. The fore-end of the gaff, where it embraces the mast, is termed the jaw, the outer end the peak. The jaw forms a semicircle, and is secured in its position by a jaw-rope passing round the mast.

GAGE, Lyman Judson, American financier was born in De Ruyter, Madison co., N. Y., in 1836. In 1868 he became assistant cashier of the First national bank of Chicago, and in 1891 became its president. In 1892 he was elected president of the board of directors

of the World's Columbian exposition. In 1897 he was appointed by President McKinley secretary of the treasury, which office he continued to hold in McKinley's second administration and in that of President Roosevelt's up to January, 1902, when he resigned.

GAGE, Thomas, Lord, was born in England in 1720. He entered the army at an early age, was made major-general and governor of Montreal in 1761 and in 1763 succeeded to the command of the British forces in America. In 1774

General Gage.

he was appointed governor of Massachusetts and in that capacity was intrusted with carrying into effect the Boston Port Act. The battle of Lexington in which a detachment sent by him on April 18, 1775, to destroy the cannon and ammunition at Concord was defeated, inaugurated the American Revolutionary War. Although Gage gained the nominal victory at Bunker Hill he was unable to raise the siege at Boston and he was shortly after superseded by General Howe. He died in 1787.

GAG RULES, the name given to the resolutions passed by the house of representatives in 1837 against the reading, referring, debating or printing of any petition praying for the interference of the national government with the institution of slavery in any part of the United States. Each year at the opening of congress an effort was made to rescind the rule but not not until 1844 was it successful.

GAHNITE, a name given to automolite after Gahn. It is a native aluminate of zinc, crystallizes in octa- and tetra-hedrons, is of dark green or black color, and is not affected by the blowpipe, or by acids or alkalies.

GAINSBOROUGH, Thomas, an English painter was born at Sudbury, in Suffolk, in 1727. He was one of the original thirty-six academicians. He rivaled Sir Joshua Reynolds as a portrait-painter, and showed no less originality in landscape. His works are now very highly esteemed, more so than at any previous time. His death took place in 1788.

GAIUS, or **CAIUS,** a Roman lawyer of the time of Adrian and Antoninus Pius, of whose life very little is known. Of his numerous works, his Institutes are particularly important; first, as having been for centuries, down to the time of Justinian, one of the most common manuals of law; secondly, as having been the foundation of the official compendium of the law which occupies an important place in the reform of the judicial system by Justinian; and thirdly, as the only tolerably full, systematic, and well-arranged source of the old Roman law. The bulk of the work in MSS. was discovered in 1816 by Niebuhr.

GALAP'AGOS, a group of thirteen islands of volcanic origin in the North Pacific Ocean, about 600 miles west of the coast of Ecuador, to which they belong; area, 2950 sq. miles. The most important are Albemarle, 60 miles long by 15 broad, and rising 4700 feet above the sea; Indefatigable, Chatham, Charles, James, and Narborough. Of these some are used by the Republic of Ecuador as penal settlements. Many of the fauna and flora of the islands are peculiar to them, the most remarkable being a large lizard and the elephant tortoise.

GALATE'A, in classic mythology, the daughter of Nereus and Doris, who rejected the suit of the Cyclops Polyphemus and gave herself to the Sicilian shepherd Acis. The monster having surprised them crushed Acis beneath a rock.

GALATIA, the ancient name of an extensive region in Asia Minor, so called from its Gallic inhabitants, who in the first place formed part of the invading hordes of Gauls under Brennus in the 3d century B.C. These were compelled by Attalus, king of Pergamos, to settle within well-defined limits between Paphlagonia, Pontus, Cappadocia, Lycaonia, Phrygia, and Bithynia. With the Gauls were intermingled a considerable proportion of Greeks; hence the inhabitants were often called Gallogræci, as well as Galatians.

GALATIANS, Epistle to the, one of the most important epistles of St. Paul, written probably about 56 A.D., soon after his second visit to Galatia, recorded in Acts xviii. 23. It was directed against the spread of Judaistic practices in the Galatian churches and especially against the practice of circumcision. It has been the subject of numerous commentaries by Luther, Winer, Meyer, Ellicott, Alford, and others.

GALATZ, or **GALACZ,** a town and port in Roumania, in Moldavia, on the left bank of the Danube, between the confluence of the Sereth and Pruth. When made a free port in 1834 it had only 8000 inhabitants, but the population has since grown to 80,000. It ceased to be a free port in 1883.

GAL'AXY, in astronomy, that long luminous track which is seen at night stretching across the heavens from horizon to horizon, and which, when fully traced, is found to encompass the heavenly sphere like a girdle. This luminous appearance is occasioned by a multitude of stars so distant and blended as to be distinguishable only by the most powerful telescopes. At one part of its course it divides into two great branches, which remain apart for a distance of 150° and then reunite; there are also many other smaller branches that it gives off. At one point it spreads out very widely, exhibiting a fan-like expanse of interlacing branches nearly 20° broad; this terminates abruptly and leaves here a kind of gap. At several points are seen dark spots in the midst of some of the brightest portions; one of the most easily distinguished of these dark spots has long been known as the "coal-sack." According to Herschel's hypothesis, our sun and planetary system form part of the milky way.

GALEN, properly Claudius Galenus, a Greek physician, born A.D. 130, at Pergamus in Asia Minor. The most valuable of his works were those dealing with anatomy and physiology, and he was the first to establish the consultation of the pulse in diagnosis and prognosis. Till the middle of the 16th century his authority in medicine was supreme.

GALE'NA, the sulphide of lead, found both in masses and crystallized in cubes, but sometimes in truncated octahedra; its color is bluish-gray, like lead, but brighter; luster metallic; texture foliated, fragments cubical; soft, but brittle; specific gravity, 7·22 to 7·759; effervesces with nitric and hydrochloric acids. For the most part it contains about 86·6 per cent of lead and 13·4 of sulphur, generally some silver, and also antimony, zinc, iron, and bismuth. Where the proportion of silver is high it is known as argentiferous galena, and worked with a view to the extraction of this metal. Galena occurs principally in the older or primary rocks, being found in England mainly in the mountain limestone (base of the carboniferous formation). In the U. States it is very abundant, the deposit of galena in which the mines of Illinois are situated being the most extensive and important hitherto discovered.

GALENA, a city of remarkable growth during the last ten years in Cherokee co., Kan., seven miles west of Joplin, Mo., on the Saint Louis and San Francisco and the Kansas City, Fort Scott and Memphis railroads. It is engaged chiefly in mining, being the center of an important lead and zinc region. Pop. 12,000.

GALERIUS, a Roman emperor. See Maximianus.

GALESBURG, a city in Knox co., Illinois. It has railroad workshops, iron foundries, manufactures of agricultural implements, etc. Knox college and Lombard university are situated here. Pop. 20,000.

GALICIA, Kingdom of, a province of Austria, bounded by Russia, Bukowina, Hungary, and Moravia; area, 30,312 sq. miles; pop. (Polish in the west, Russniak in the east) 7,295,538. The great physical features of the country are, in a manner, determined by the Carpathians which form a long and irregular curve on the south, and send out branches into Galicia. Farther to the north the hills subside rapidly, and finally merge into vast plains. It has several considerable rivers, those on the west being affluents of the Vistula, those in the east, of the Danube and Dniester. The climate is severe, particularly in the south, where more than one of the Carpathian summits rise beyond the snow-line. The summers are very warm but comparatively short. The soil in general is fertile, and yields abundant crops of cereals, hemp, flax, tobacco, etc. The domestic animals include great numbers of horned cattle and a fine hardy breed of horses. Sheep are in general neglected; but goats, swine, and poultry abound, and bee-keeping is practiced on a large scale. Bears and wolves are still found in the

forests; and all the lesser kinds of game are in abundance. The minerals include marble, alabaster, copper, calamine, coal, iron, and rock-salt. Only the last two are of much importance.

GALICIA, one of the old provinces of Spain, situated in the n.w., and bounded n. and w. by the Atlantic, s. by Portugal, and e. by the old provinces of Asturias and Leon. It is now divided into the provinces of Coruña, Lugo, Orense, and Pontevedra; area, 11,212 sq. miles. The peasantry are very poor, and many leave for service in other parts of Spain. Pop. 1,941,023.

GAL'ILEE, in the time of Jesus Christ, the most northern province of Palestine, bounded on the e. by the river Jordan, on the s. by Samaria, on the w. by the Mediterranean Sea and Phœnicia, and on the n. by Syria and the Mountains of Lebanon. It was in some sense the cradle of Christianity, Nazareth, Cana, Capernaum, Nain, and other places being intimately associated with the life of Christ. The inhabitants of this country, mostly poor fishermen, on account of their ignorance and simplicity of manners were despised by the Jews, who, by way of contempt, called Christians, at first, Galileans. At present Galilee is included in the vilayet of Syria.

GALILEE, Sea of, also called Sea of Chinnereth or Chinneroth, and the Lake of Gennesaret or Tiberias, a pear-shaped fresh-water lake in Central Palestine, 12½ miles long by 7½ broad. It was apparently formed by subsidence attended with volcanic disturbance; and is 682 feet below the level of the Mediterranean. On the east the coasts are nearly 2000 feet high, deeply furrowed by ravines but flat along the summit. The whole basin is bleak and monotonous, and has a scathed volcanic look, the cliffs and rocks along the shore being of hard porous basalt. At the time of Christ there were on its shores nine flourishing cities, of which seven are now uninhabited ruins, while Magdala and Tiberias are both in a poverty-stricken condition. The lake still abounds in fish, but the fishery is neglected.

GALILEI (gȧl-i-lā'ē), Galileo, a most distinguished Italian physicist, born 8th Feb., 1564, as Pisa. His father Vincenzo Galilei, a nobleman of Florence procured him an excellent education in literature and the arts, and in 1581 he entered the University of Pisa. At nineteen the swinging of a lamp in Pisa cathedral led him to investigate the laws of the oscillation of the pendulum, which he subsequently applied in the measurement of time; and in 1586 the works of Archimedes suggested his invention of the hydrostatic balance. He now devoted his attention exclusively to mathematics and natural science, and in 1589 was made professor of mathematics in the University of Pisa. In 1592 he was appointed professor of mathematics in Padua, where he continued eighteen years, and his lectures acquired European fame. Here he made the important discovery that the spaces through which a body falls, in equal times, increase as the numbers 1, 3, 5, 7. If he did not invent he improved the thermometer, and made some interesting observations on the magnet. To the telescope, which in Holland remained not only imperfect but useless, he gave a new importance. He noted the irregularity of the moon's surface, and taught his scholars to measure the height of its mountains by their shadow. A particular nebula he resolved into individual stars, and conjectured that the milky way might be resolved in the same manner. His most remarkable discovery was that of Jupiter's satellites (1610), and he observed, though imperfectly, the ring of Saturn. He also detected the sun's spots, and inferred, from their regular advance from east to west, the rotation of the sun, and the inclination of its axis to the plane of the ecliptic. In 1610 Cosmo II., Grand-duke of Tuscany, appointed him grand-ducal mathematician and philosopher, and with increased leisure he lived sometimes in Florence, and sometimes at the country seat of his friend Salviata, where he gained a decisive victory for the Copernican system by the discovery of the varying phases of Mercury, Venus, and Mars. In 1611 he visited Rome for the first time, where he was honorably received; but on his return to Florence he became more and more involved in controversy, which gradually took a theological turn. The monks preached against him, and in 1616 he found himself again obliged to proceed to Rome, where he is doubtfully said to have pledged himself to abstain from promulgating his astronomical views. In 1623 Galileo replied to an attack upon him in his Saggiatore, a masterpiece of eloquence, which drew upon him the fury of the Jesuits. In 1632 with the permission of the pope, he published a dialogue expounding the Copernican system as against the Ptolemaic. A congregation of cardinals, monks, and mathematicians, all sworn enemies of Galileo, examined his work, condemned it as highly dangerous, and summoned him before the tribunal of the inquisition. The veteran philosopher was compelled to go to Rome early in 1633, and was condemned to renounce upon his knees the truths he had maintained. At the moment when he arose, he is said (but this is doubtful) to have exclaimed, in an undertone, stamping his foot, "E pur si muove!" (and yet it moves). Upon this he was sentenced to the dungeons of the inquisition for an indefinite time, and every week, for three years, was to repeat the seven penitential psalms of David. After a few days' detention his sentence of imprisonment was commuted to banishment to the villa of the grand-duke of Tuscany at Rome, and then to the archiepiscopal palace at Sienna. He was afterward allowed to return to his residence at Arcetri, near Florence, where he employed his last years principally in the study of mechanics and projectiles. The results are found in two important works on the laws of motion, the foundation of the present system of physics and astronomy. At the same time he tried to make use of Jupiter's satellites for the calculation of longitudes; and though he brought nothing to perfection in this branch, he was the first who reflected systematically on such a method of fixing geographical longitudes. He was at this time afflicted with a disease in his eyes, one of which was wholly blind, and the other almost useless, when, in 1637, he discovered the libration of the moon. Domestic troubles and disease embittered the last years of Galileo's life. He died 8th Jan., 1642 (the year Newton was born). His remains were ultimately deposited in the church of Sta. Croce, at Florence.

GALL, in the animal economy. See Gall-bladder, Bile.

GALL, Franz Joseph, the founder of phrenology, born in 1758 in Tiefenbrunn in Baden. After a series of comparisons of the skulls both of men and animals he was led to assign the particular location of twenty organs. Gall's discoveries, which met with severe criticism at least gave an impulse to the accurate anatomical study of the brain. Dr. Gall died in 1828.

GALL, St. (German, St. Gallen), a northeastern frontier canton in Switzerland, abutting on Lake Constance, partly bounded by the Rhine, and inclosing the canton of Appenzell. Its area is 780 sq. miles. In the south it is one of the loftiest Alpine districts of Switzerland, and in other quarters is more or less mountainous. It belongs wholly to the basin of the Rhine, in the valley of which the climate is comparatively mild, in the mountainous districts it is very rigorous. The constitution is one of the most democratic in Switzerland. German is the language spoken. Pop. 228,174.—St. Gall, the capital and the see of a bishop, is situated on the Steinach, 2,165 feet above sea-level. Pop. 36,344.

GALLAIT (gȧl-lā), Louis, Belgian historical painter, born 1812, died 1887.

GALLAND (gȧl-ăn), Antoine, a French oriental scholar, born in Picardy in 1646, principally known for his translation of the Arabian Nights Entertainments (1704–1717), the first into any European language. He died in 1715 while engaged in translating the Koran.

GALLATIN, Albert, American statesman and financier, was born in Geneva, Switzerland, in 1761; came to U. States in 1780 and after poor success in trade became a teacher of French. After serving in Pennsylvania legislature became a member of congress and was a leading critic of the poor state of the national finances. Jefferson in 1801 made him secretary of the treasury and in the eleven succeeding years he prevented the disorganization of the public financial system and laid the foundations of business-like administration. From 1816 to 1823 he was minister to France and afterwards minister to London. He died in 1849.

GALL-BLADDER, a small membranous sac, shaped like a pear, which receives the gall or bile from the liver by the cystic duct. It is situated on the inferior surface of the right lobe of the liver.

GALLE (gal), a seaport near the southwest extremity of Ceylon, on a low rocky projecting point of land. Pop. 37,326.

GAL'LEON, formerly a kind of vessel of war, used by the Spaniards and Portuguese, with from three to four decks. In more recent times those vessels were called galleons in which the Spaniards

transported treasure from their American colonies.

GAL'LERY, in architecture, a long, narrow room, the length of which is at least three times its width, often built to receive a collection of pictures. Among the most renowned European art-galleries are those of the Louvre at Paris, that of Versailles, the National Gallery in London, the Pitti and Uffizi galleries at Florence, the Dresden Gallery, the Real Museo of the Prado at Madrid, the Hermitage at St. Petersburg, the gallery of Berlin, the gallery of the Museo Borbonico at Naples, those at Venice, Antwerp, Turin, etc. The term gallery is also sometimes applied to what is more properly termed a corridor, likewise to a platform projecting from the walls of a building supported by piers, pillars, brackets, or consoles, and in churches, theaters, and similar buildings, to the upper floors going round the building next the wall.

GALLEY, a low, flat-built vessel with one deck, and navigated with sails and oars, once commonly used in the Mediterranean. The common galleys varied from 100 to 200 feet in length, those of smaller sizes being known respectively as half-galleys and quarter galleys. They carried as many as twenty oars on each side, each oar worked by one or more men, and they had commonly two masts with lateen sails. Raised structures in the stern, and even in the prow, were not uncommon. These, however, were more fully developed in the kind of galley known as the galleass, which carried three masts, from 200 to 300 rowers, and sometimes twenty guns. France formerly had a number of galleys for service in the Mediterranean, in which convicts were forced to labor. The term galley is also applied to the ships of the ancient Greeks and Romans, especially to their war-ships, which were propelled chiefly by oars.

GALLEY-SLAVE, a person condemned to work at the oar on board a galley, being chained to the deck. This mode of punishment was common in France previous to 1748.

GALL-FLY, a name for several insects which form the morbid products known as galls, each species seeming to be addicted to a particular plant and a particular part of the plant. The tumor or gall is due to the morbid action of an irritating fluid deposited with the egg of the insect. The large galls at the base of oak leaves are produced by a fly of a brown color, with black antennæ, chestnut brown legs, and white wings. The small galls on the under surface of oak leaves are due to another species. See Galls.

GALLIC ACID, an acid which derives its name from the gall-nut, whence it was first procured by Scheele in 1786. It exists ready formed in the seeds of the mango, has been found besides in many other plants, in acorns, colchicum, divi-divi, hellebore root, sumach, tea, walnuts, etc., and is a product of the decomposition of tannic acid. It crystallizes in brilliant prisms, generally of a pale-yellow color. It colors the persalts of iron of a deep bluish black. It is of extensive use in the art of dyeing, as it constitutes one of the principal ingredients in all the shades of black, and is employed to fix or improve several other colors. It is well known as an ingredient in ink. See Ink.

GAL'LICAN CHURCH, a distinctive name applied to the Roman Catholic Church in France. Latterly, and especially since the Vatican Council of 1870 the position of the Gallican Church toward the popes has essentially changed and the older Gallicanism may now be said to be represented by the Old Catholics of France.

GAL'LIOT, a Dutch or Flemish vessel for cargoes, with very rounded ribs and flattened bottom, with a mizzen-mast

Dutch galliot.

placed near the stern, carrying a square main-sail and main-top-sail, a forestay to the main-mast (there being no fore-mast), with forestay-sail and jibs.

GALLIP'OLI, a town in European Turkey, on a peninsula of the same name at the northeast end of the Dardanelles, 128 miles w.s.w. of Constantinople. Pop. about 50,000.

GAL'LIUM, a rare malleable metal, discovered by spectrum analysis in 1875 by De Boisbaudran in the zinc-blende of Pierre-fitte in the Pyrenees. It is of a grayish-white color, has a brilliant luster, and is fused by the mere warmth of the hand. In its properties it is related to aluminium.

GALLON, a standard measure of capacity, containing 277.27384 cubic inches being equal to 4 quarts or 8 pints. In England formerly three different gallons were in use, the old corn-gallon of 268.8 cubic inches, the old wine-gallon of 231 cubic inches, and the old beer-gallon of 282 cubic inches. The gallon of 231 cubic inches has been adopted the standard of the U. States.

GALLS, gall-nuts or nut-galls, a vegetable excrescence produced by the deposit of the egg of an insect in the bark or leaves of a plant. The galls of commerce are produced by a species of Cynips in the tender shoots of a species of oak, abundant in Asia Minor, Syria, Persia, etc. They are spherical and tubercular, and vary in magnitude from the size of a pea to that of a hazel-nut. White, green, and blue varieties are recognized, the latter kinds being the best. They are inodorous, but are strongly astringent from the tannin and gallic acid which they contain, and which are their chief products. Gall-nuts are extensively used in dyeing and in the manufacture of ink, and they are also frequently used in medicine. They are chiefly imported from Aleppo, Tripoli, and Smyrna. The Chinese galls, or woo-pei-tsze, differ from the foregoing in that they are really an unusually massive

Aleppo gall and gall-fly.

1, Gall split to show the cell in which the larva exists. 2, Exterior of the gall, showing the opening by which the perfect insect escapes.

kind of crust or cocoon, such as the aphides form on the surface of a plant; the tissues of the plant are not affected. Since the opening of the Japanese ports these have been imported in considerable quantities.

GALVANI, Luigi, Italian physician and physiologist, born at Bologna 1737, died 1798. He practiced medicine in Bologna, and was in 1762 appointed professor of anatomy at the university. He gained repute as a comparative anatomist; but his fame rests on his theory of animal electricity, enunciated in the treatise De Viribus Electricitatis in Motu Musculari Commentarius, published in 1791. Twenty years before the publication of this treatise he had been making experiments on the relations of animal functions to electricity. In 1797 he was deprived of his chair for refusing to take the oath of allegiance to the Cisalpine republic, but was restored to it in less than a year.

GALVANIC BATTERY, a combination of galvanic cells. In a galvanic cell chemical action takes place between a liquid and a metal—usually zinc—which is partially immersed in it; and there is another metal, or solid conduct-

Fig. 1.—Simple galvanic battery.

ing substance of some kind, also partially immersed. The zinc and the other solid conductor are called the two plates of the cell. The plates must not be allowed to touch each other in the liquid but a current through an external conductor can be obtained by connecting its ends with the two plates. When this connection is made there is a complete circuit round which the current flows its course being from the zinc plate through the liquid to the other plate and from this latter through the external conductor to the zinc plate again. There is a continual circulation of positive electricity in this direction as long as the chemical action continues, or what is the same thing, there is a con

tinual circulation of negative electricity in the opposite direction. The second or inactive plate is usually either of copper, of platinum, or still more frequently of gas carbon, that is, the carbon which is deposited in the retorts at gas-works. The liquid which acts on the zinc is most frequently dilute sulphuric acid—1 part of acid to 6 or 8 of water. In some of the best kinds of cell there are two liquids—one in contact with the zinc and the other with the inactive plate, with a

Fig. 2.—Bunsen's battery.

porous partition of unglazed earthenware between them. Fig. 1 shows a battery of four cells of the simplest kind, each containing a plate of zinc and a plate of copper immersed (except their upper portions) in dilute acid contained in a glass vessel. It will be observed that the copper (c) of each cell is connected with the zinc (z) of the next. The arrows show the direction of the current. Fig. 2 represents a very common form of battery called Bunsen's. The zinc plate consists of a slit cylinder surrounding the porous vessel in which the carbon plate stands, the whole being contained in a glass jar. The liquid in which the zinc is immersed is dilute sulphuric acid, and the liquid in contact with the carbon is strong nitric acid. Fig. 3 represents a Daniell's cell, which differs from Bunsen's in the contents of the porous cell. The plate within the porous cell is of copper, and the liquid in contact with the copper is a saturated solution of sulphate of copper, crystals of which are seen heaped up round the top. These

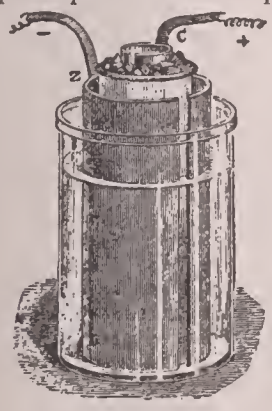


Fig. 3.—Daniell's cell.

crystals are supported by a cage of copper wire, and are intended for keeping the solution saturated.

In the simpler forms of galvanic cell, such as that represented in Fig. 1, there is a continual evolution of hydrogen at the inactive plate, while an equivalent quantity of oxygen enters into combination with the zinc plate, and goes to form sulphate of zinc. Some of the evolved hydrogen adheres to the copper plate and produces a rapid falling off in the eletromotive force of the cell. This action, which is the principal cause of the rapid weakening of the current in batteries composed of such cells, is called polarization. The purpose of the two-fluid arrangement illustrated in Figs. 2 and 3, is to intercept the hydrogen and prevent it from being deposited on the copper or carbon plate. In Daniell's battery, which was the first of the kind, the hydrogen is taken up by the solution of sulphate of copper, and displaces copper, which is deposited on the copper plate. In Bunsen's it is taken up by the nitric acid, which is thus gradually converted into nitrous acid.

It is usual to amalgamate the zinc plates of a battery, by washing them with acid, and then rubbing them with mercury. The reason for this operation is, that when ordinary commercial zinc is used without amalgamation, local currents are formed between different portions of the same plate, owing to inequalities or impurities. This local action, as it is called, eats away the plates without contributing to the current in the general circuit. Amalgamation renders the surface uniform and prevents this injurious action.

The strength of the current given by a battery depends partly on the electromotive force of the battery and partly on its resistance. If two batteries are connected into one circuit in such a way that they tend to drive currents round it in opposite directions, the one which prevails is said to have the greater electromotive force. The electromotive force is proportional to the number of cells, and is independent of their size. As regards resistance, the current will be strongest when the resistance is least, that is when the plates are very large and very near together.

Whenever chemical action takes place, heat is produced; but in the ordinary use of a galvanic battery only a portion of this heat is produced in the cell themselves; the rest of it is produced in the external conductor. When we heat a wire by sending the current of a battery through it, the heat generated in the wire is a portion of the heat due to the chemical action in the cells. In cells of high electromotive force the heat due to the chemical action is greater (for the same quantity of zinc dissolved) than in cells of low electromotive force. It is much higher for a Bunsen than for a Daniell cell.

GALVANIZED IRON, a name loosely given to sheets of iron coated with zinc by a non-galvanic process, the iron being first cleansed by friction and the action of dilute sulphuric acid, and then plunged into a bath composed of melted zinc and other substances, as sal-ammoniac, or mercury and potassium; more properly the name is given to sheets of iron coated first with tin by a galvanic process, and then with zinc by immersion in a bath containing fluid zinc covered with sal-ammoniac mixed with earthy matter. So long as the coating is entire, and so long as it is not exposed to corrosive substances, galvanized iron is very durable.

GALVANOMETER, an instrument for measuring an electric current by the deflection of a magnetic needle. The current flows through a wire coiled usually into the form of a circle, which is placed vertically in the magnetic meridian and surrounds the needle. When no current is passing the needle points north and south, and the galvanometer should be so placed that the needle when so pointing lies in the plane of the coil. When a current passes through the coil, it exerts a force upon the needle tending to set it at right angles to the plane of the coil—that is, to set it east and west. The action of the earth on the other hand tends to set it north and south, and it will actually take an intermediate position which varies with the strength of the current. This position is read off on a graduated circle usually by means of a long light pointer which is attached to the needle at right angles. In some galvanometers, as in that represented in Figure 2, the coil can be turned till it

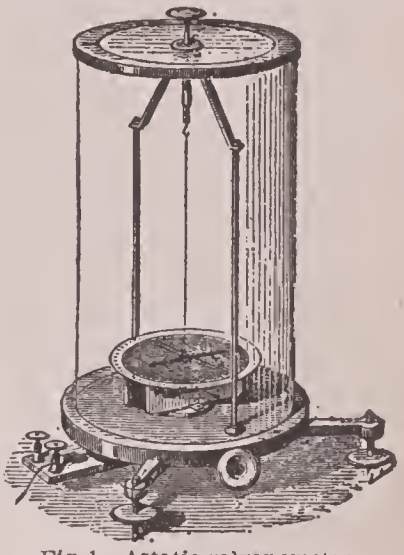


Fig. 1.—Astatic galvanometer.

Fig. 2.—Sine galvanometer.

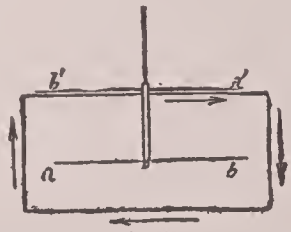


Fig. 3.

Fig. 4.—Mirror galvanometer.

overtakes the needle. The lower graduated circle is for the purpose of measuring the amount of this rotation.

For measuring very feeble currents, it is more usual to employ the "astatic" galvanometer, represented in Fig. 1. It has two needles, a′ b′, a b (Fig. 3), as nearly equal as possible, fastened to one upright stem, with their poles pointing opposite ways. The directive actions of the earth on the two needles are opposite, and hence the resultant directive action of the earth on the two combined is very small. The coil of the galvanometer, on the other hand, is so placed that the current tends to deflect both needles

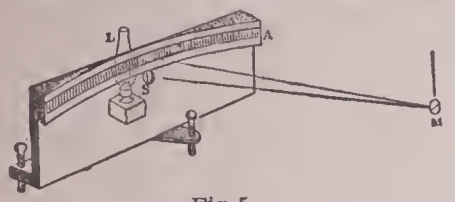


Fig. 5.

the same way. The coil, which is shown in section in Fig. 3, is approximately rectangular, its longest dimension being horizontal. One of the needles a′ b′ is just above, and the other a b is below the upper part of the coil. The current in this part of the coil would urge them opposite ways if their poles were similarly directed, but as their poles are oppositely directed it urges them the same way. The current in the lower part and ends of the coil assists in deflecting the lower needle, and is too distant from the upper needle to have much effect upon it. The coil is thus placed in a position of great advantage as compared with the earth, and the deflection is proportionately large.

Much greater sensitiveness can be obtained by the use of the mirror-galvanometer, Fig. 4. The round box in the center contains a coil of some hundreds of convolutions, with a very small needle fastened to a little glass mirror suspended in its center by a silk fiber. The mirror, with the needle fastened to its back, is shown at m in Fig. 5. Light from a lamp l comes through the hole s and falls upon the mirror, which, being slightly concave, reflects it to a focus on the scale aa, where a bright image of the flame is accordingly seen. The smallest angular movement of the mirror causes a very visible movement of the bright image on the scale. The curved bar m in Fig. 4 is a magnet (called the controlling magnet), which can be raised or lowered, and turned round. One use of it is to bring the needle into the plane of the coil when the coil is not standing north and south. It is better, however, to keep the coil north and south, and then the magnet m can be used to annul the earth's magnetism, thus conferring the same advantage which is obtained by the use of two needles in the astatic galvanometer.

For the general principle which governs the deflection of a needle by a current, see Electromagnetism.

GAL'VESTON, a city and seaport of Texas, at the northeast extremity of Galveston Island, at the mouth of Galveston Bay, about 450 miles south by west from New Orleans. It is one of the most flourishing ports in the Gulf of Mexico. Large quantities of cotton are shipped, the export to Great Britain alone being over 400,000 bales annually. The chief buildings are the custom and market houses, the town-hall, a number of churches, including a Gothic Episcopal Church and Roman Catholic cathedral, and the Roman Catholic university of St. Mary. Immense loss of life and damage to property was caused by a hurricane in 1900. Pop. 39,000.

GAL'WAY, a seaport of Western Ireland, prov. of Connaught, capital of county of same name, at the mouth of the Corrib, in Galway Bay, 117 miles west of Dublin. Pop. 13,414.—The county, which is washed by the Atlantic, has an area of 1,502,362 acres, of which one-eighth is under crops. In the northwest, or district of Connemara, it is rugged and mountainous; in the east, level but extensively covered with bog; and in the south, fertile and tolerably well cultivated, producing wheat, barley, and oats. Lough Corrib, which lies wholly within it, dividing the county into the e. and w. districts, is the third largest lake in Ireland. The minerals include lead, limestone, marble, and beautiful serpentine. The fisheries are valuable, but much neglected. The principal manufactures are coarse woolens and linens. Pop. 192,146.

GAMA, Dom Vasco da, the first navigator who made the voyage to the East Indies by the Cape of Good Hope, was born in 1450 at Sines, Portugal, of a noble family. The voyage had been projected under John II., and his successor, Emmanuel the Fortunate, having fitted out four vessels, intrusted Gama with the chief command. He sailed from Lisbon on July 8th, 1497, and doubling the Cape, visited Mozambique, Mombaza, Melinda, and Calicut, returning to Lisbon in 1479. For this exploit he was named Admiral of the Indies and received the title of Dom, with an annual pension and extensive privileges in Indian commerce. In the year 1502 he was placed at the head of a powerful fleet, with which he provided for the security of future voyagers by founding establishments at Mozambique and Sofala. He also inflicted signal reprisals on the town of Calicut, where the Portuguese residents had been massacred, and established the first Portuguese factory in the Indies. He re-entered Lisbon in 1503, and passed the next twenty years in obscurity. In 1524 he was appointed Viceroy of India by King John III., but his administration lasted only three months, his death taking place at Goa in December of that year.

GAMA'LIEL, the name of two persons mentioned in Bible history, of whom the first, Gamaliel, the son of Pedahzur (Numbers i. 10; ii. 20; vii. 54, 59; x. 23), was prince or head of the tribe of Manasseh. The other and better known Gamaliel is mentioned twice in the Acts of the Apostles, as a learned doctor of the law, of the sect of the Pharisees.

GAMBET'TA, Léon Michel, a French orator and statesman, born in 1838 at Cahors, of a family of Genoese extraction. On the downfall of the empire, after the surrender of Sedan in 1870, a government for the national defense was formed, in which Gambetta was nominated minister of the interior. The accidental discharge of a pistol caused his death at Paris in December, 1882.

GAMBIA, a British colony and protectorate in West Africa. Pop. 90, 000 (14,000 in colony).

GAMBIER ISLANDS, a group of small coral islands in the South Pacific, about lat. 23° 8′ s. and lon. 134° 55′ w.; belonging to France. Pop. about 2300.

GAMBLING, or **GAMING,** the practice of indulging in games involving some element of chance or hazard with a view to pecuniary gain. In many countries such games, and the collateral practices of betting on events, taking shares in lotteries, etc., are legally prohibited or restricted as frequently associated with fraud and as themselves demoralizing. At other times governments, tempted by the prospect of gain, have openly encouraged gambling by licensing gaming-houses, or instituting lotteries under their own authority. (See Lottery.) In France public gaming-tables were suppressed from 1st January, 1838, but lotteries are still sometimes carried on. Previous to the formation of the German Empire gambling was encouraged in both of the ways referred to in several of the principalities of Germany. Baden-Baden, in the Grand-duchy of Baden, and Homburg, in Hesse-Homburg, were the two most famous resorts in Europe of the frequenters of gaming-tables. After the formation of the empire gaming was suppressed in these places (31st December, 1872), and since that time the Italian principality of Monaco has become the last public resort of this species of gambling.

In the U. States one who keeps a gambling house is indictable at common law for maintaining a nuisance, and one who wins another's money with false dice, or the like, is punishable as a common law cheat.

GAMBOGE, a concrete, vegetable, inspissated juice or sap, or gum-resin, yielded by several species of trees, with handsome laurel like foliage and small yellow flowers. As a drug it has drastic purgative properties, but it is seldom administered alone. In doses of a drachm or even less it produces death.

GAME LAWS, laws relating to the killing of certain wild animals pursued for sport, and called game. Formerly in Britain certain qualifications of rank or property were needed to constitute the right to kill game; but by the Game Act of Will. IV. the necessity for any qualification except the possession of a game certificate was abolished, and the right given to any one to kill game on his own land, or on that of another with his permission.

In the U. States the chief restrictions are in regard to killing wild animals during the breeding season.

The following table shows the close season for all game in the U. States, with the exception of mountain sheep and goat and a few unimportant species. Where no dates are given kind of game does not exist or close season at all times. The first date of the close season and the first date of the open season are given. Open season may be found by reversing the dates.

		MAMMALS.				BIRDS.						
		Deer.	Elk, Antelope, Moose, Caribou.	Squirrel.	Rabbit.	Quail.	Grouse and Prairie Chicken.	Wild Turkey.	Pheasant.	Woodcock.	Duck, Goose, Swan.	Plover, Snipes, Rail.
1	Alabama [11]	Jan. 1-Sep. 1		Feb. 2-July 1		Local laws	Local laws	Local laws	Mar. 2-Nov. 15	Mar. 2-Nov. 15		
2	Alaska [11]	Feb. 1-Aug. 1	Jan. 1-Sept. 1 [2]				Dec. 16-Sept. 4				Feb. 1-Sept. 1	Dec. 16-Sept. 1
3	Arizona [11]	Dec. 1-Sept. 15	At all times			Mar. 1-Oct. 15	Mar. 1-Oct. 15	Dec. 1-Sept. 15	Mar. 1-Oct. 15			
4	Arkansas [11]	Feb. 1-Sept. 1 [12]				Feb. 15-Nov. 1	Dec. 1-Oct. 31	Mar. 1-Nov. 1				
5	California [11]	Oct. 15-Aug. 1	At all times	Feb. 1-Aug. 1		Feb. 15-Oct. 15	Feb. 15-Oct. 1		At all times		Feb. 15-Oct. 15	Feb 15-Oct. 15
6	Colorado	Oct. 1-Sept. 25	To 1907			To Oct. 1, 1920 [9]	Oct. 21-Sept. 1	To 1907	At all times		April 16-Sept. 10	April 16-Sept. 10
7	Connecticut [11]	To June 1, 1911		Dec. 1-Oct. 1	Jan. 1-Oct. 1	Dec. 1-Oct. 1	Dec. 1-Oct. 1		June 1, 1906	Dec. 1-Oct. 1	May-Sept. 1	April 1-Sept. 1 [5]
8	Delaware				Jan. 1-Nov. 15	Jan. 1-Nov. 15	Jan. 1-Nov. 15				April 15-Oct. 1	
9	Dist. of Col. [11]	Jan. 1-Sept. 1		Feb. 1-Nov. 1	Feb. 1-Nov. 1	Mar. 15-Nov. 1	Dec. 26-Nov. 1	Dec. 26-Nov. 1		Jan. 1-July 1	April 1-Sept. 1	April 1-Sept. 1
10	Florida	Feb. 1-Nov. 1				Mar. 1-Nov. 1		Mar. 1-Nov. 1			April 1-Oct. 1	
11	Georgia	Jan. 1-Sept. 1				Mar. 15-Nov. 1	Mar. 15-Nov. 1	Mar. 15-Nov. 1	Nov. 30, 1905	Feb. 1-Sept. 1	Feb. 1-Sept. 1 [10]	
12	Idaho	Jan. 1-Sept. 1	Jan. 1-Sept. 1 [1]			Dec. 1-Nov. 1	Dec. 1-Aug. 15		Mar. 11, 1907		Feb. 15-Sept. 15	July 15-Feb. 15
13	Illinois	To 1913		Jan. 1-July 1		Dec. 20-Nov. 10	To 1907	To 1908	To 1908	Dec. 1-Aug. 1	April 15-Sept. 1	May 1-Sept. 1
14	Indiana	At all times		Jan. 1-Nov. 10		Jan. 1-Nov. 10	Jan. 1-Nov. 10	At all times	At all times	Jan. 1-Nov. 10	April 15-Sept. 1	
15	Long Island	4 days in Nov. [13]		Jan. 1-Nov. 1	Jan. 1-Nov. 1	Jan. 1-Nov. 1	Jan. 1-Nov. 1		Jan. 1-Nov. 1	Jan. 1-Aug. 1	Jan. 1-Oct. 1	Jan. 1-July 1
16	Iowa	At all times	At all times	Jan. 1-Sept. 1		Dec. 15-Nov. 1	Dec. 1-Sept. 1	Dec. 1-Nov. 1		Jan. 1-July 10	April 15-Sept. 1	April 15-Sept. 1
17	Kansas [11]		At all times			Dec. 1-Nov. 15 [6]	Oct. 1-Aug. 15 [8]		Feb. 28, 1907		April 25-Sept. 1	Sept. 15-July 15
18	Kentucky	Mar. 1-Sept. 1		Feb. 1-Nov. 15		Jan. 1-Nov. 16	Jan. 1-Nov. 15	Feb. 1-Sept. 1		Feb. 1-June 20	April 1-Sept. 1	
19	Louisiana [11]				April 1-Nov. 2	Mar. 1-Nov. 1		April 1-Dec. 1			April 1-Sept. 1	Dec. 1-Sept. 1
20	Maine	Dec. 15-Oct. 1 [12]	Dec. 1-Oct. 15 [2]		April 1-Sept. 1	At all times	Dec. 1-Sept. 15		To Mar. 22, 1911	Dec. 1-Sept. 13	Dec. 1-Sept. 1 [10]	May 1-Aug. 1
21	Maryland	Local laws		Dec. 1-Sept. 1	Dec. 25-Nov. 1	Dec. 25-Nov. 1	Dec. 25-Nov. 4	Dec. 25-Nov. 1	Dec. 25-Nov. 1	Dec. 25-Nov. 1	April 10-Nov. 1	May 1-Aug. 15
22	Massachu'ts [11]	To Nov. 1, 1908		Mar. 1-Oct. 1	Mar. 1-Oct. 1	Dec. 1-Nov. 1			To Feb. 13, 1905	Dec. 1-Oct. 1	Mar. 1-Sept. 1 [10]	Mar. 1-July 15
23	Michigan	Dec. 1-Nov. 10 [12]	To 1911	Dec. 1-Oct. 15		To Oct. 15, 1907	Dec. 1-Oct. 15 [3]	To 1910	To 1910	Dec. 1-Oct. 20	Jan. 2-Sept. 1	Dec. 1-Oct. 1
24	Minnesota	Dec. 1-Nov. 10	Dec. 1-Nov. 10 [2]			Dec. 15-Oct. 1	Dec. 15-Oct. 1 [4]		At all times	Nov. 1-Sept. 1	Dec. 1-Sept. 1	Nov. 1-Sept. 1
25	Mississippi	Mar. 1-Sept. 15				May 1-Oct. 1		May 1-Oct. 1				
26	Missouri	Jan. 1-Nov. 1				Jan. 1-Nov. 1	Jan. 1-Nov. 1 [4]	Jan. 1-Nov. 1	Jan. 1-Nov. 1	Jan. 1-Aug. 1	April 1-Oct. 1	Jan. 1-Aug. 1
27	Montana	Dec. 1-Sept. 1	At all times [1]			At all times	Dec. 1-Sept. 1		At all times		Dec. 1-Sept. 1	
28	Nebraska	Nov. 16-Aug. 16	At all times [7]			Dec. 1-Nov. 15	Dec. 1-Oct. 1	At all times	At all times		April 16-Sept. 1	Oct. 31-April 15 [5]
29	Nevada [11]	Nov. 15-Sept. 15				Mar. 1-Sept. 15	Mar. 1-Sept. 15		Sept. 1, 1906	Mar. 1-Sept. 15	Mar. 1-Sept. 15	
30	New H'mps're	Dec. 1-Oct. 1	At all times	Jan. 1-Sept. 15	April 1-Oct. 1	Dec. 15-Oct. 1	Dec. 15-Oct. 1		To 1905	Dec. 15-Sept. 15	Feb. 1-Aug. 1 [10]	Feb. 4-Aug. 1 [5]
31	New Jersey	To April 14, 1905		Jan. 1-Nov. 10	Jan. 1-Nov. 10	Jan. 1-Nov. 10	Jan. 1-Nov. 10	Jan. 1-Nov. 10	Jan. 1-Nov. 1	Jan. 1-Oct. 1	May 1-Sept. 1	Jan. 1-May 1
32	New Mexico [11]	Jan. 1-Nov. 1	To Mar. 7, 1905			Mar. 1-Oct. 1	Jan. 1-Oct. 1	Jan. 1-Oct. 1	Mar. 14, 1906			
33	New York	Nov. 16-Sept. 1	At all times	Dec. 1-Sept. 16	Dec. 16-Sept. 16 [14]	Dec. 1-Nov. 1	Dec. 1-Sept. 16		To 1905	Dec. 1-Sept. 16	Jan. 1-Sept. 16	Jan. 1-Sept. 16
34	No. Carolina	Jan. 1-Oct. 1		Local laws		Mar. 15-Nov. 1		Mar. 15-Nov. 1		Local laws	Local laws	
35	No. Dakota	Dec. 1-Nov. 10	At all times			Oct. 15-Sept. 1	Oct. 15-Sept. 1		Sept. 1, 1905	Oct. 15-Sept. 1	May 1-Sept. 1	
36	Ohio	Dec. 16-Nov. 10		Oct. 15-Sept. 1	Oct. 15-Sept. 1	Dec. 2-Nov. 10	To Nov. 10, 1904	Dec. 2-Nov. 10	Nov. 10, 1904	Dec. 1-Sept. 1	Dec. 1-Sept. 1	Dec. 2-Nov. 10
37	Oklahoma [11]	At all times	At all times			Feb. 1-Oct. 1	Jan. 1-Sept. 1	Jan. 1-Sept. 1	Jan. 1-Dec. 1			Jan. 1-Aug. 1
38	Oregon	Nov. 1-Aug. 15	To Sept. 15, 1907	Jan. 1-Oct. 1		Dec. 1-Oct. 1	Dec. 1-Oct. 1	To Oct. 1, 1905	Oct. 1, 1905	Oct. 1, 1905	Mar. 1-Sept. 1	Jan 1-Aug. 1
39	Pennsylvania	Dec. 1-Nov. 1	Dec. 1-Nov. 1 [1]	Dec. 16-Oct. 15	Dec. 16-Nov. 1	Dec. 16-Nov. 1	Dec. 16-Oct. 15	Dec. 16-Oct, 15	Dec. 16-Oct. 15	Dec. 16-Oct. 15	May 1-Sept. 1 [10]	Jan. 1-Sept. 1
40	Rhode Isl. [11]	Jan. 1, 1905		Jan. 1-Nov. 1	Jan. 1-Oct. 15	Jan. 1-Nov. 1	Jan. 1-Nov. 1		To Oct. 1, 1905	Dec. 16-Oct. 15	April 1-Aug. 15 [10]	
41	So. Carolina	Jan. 1-Sept. 1 [12]				April 1-Nov. 1	April 1-Nov. 1	April 1-Nov. 1	Jan. 1, 1905	April 1-Nov. 1		
42	So. Dakota	Dec. 15-Nov. 15	Jan. 1. 1911 [1]			Jan. 1-Sept. 1	Jan. 1-Sept. 1			Jan. 1-Sept. 1	May 1-Sept. 1	May 15-Sept. 1
43	Tennessee	To Oct. 1, 1907		Mar. 1-June 1		Mar. 1-Nov. 1	Mar. 1-Nov. 1	Mar. 1-Nov. 1	Jan. 1-Dec. 1	April 15-Oct. 1	April 15-Oct. 1	April 15-Oct. 1
44	Texas [11]	Jan. 1-Nov. 1	To July 1, 1908			Feb. 1-Nov. 1	Feb. 1-Nov. 1	Feb. 1-Nov. 1	July 1, 1908			
45	Utah	To Mar. 17, 1909	At all times			At all times	Dec. 1-Aug. 15		At all times		Mar. 15-Feb. 15	
46	Vermont [11]	Oct. 29-Oct. 23	At all times		May 1-Sept. 1	Jan. 1-Sept. 1	Jan. 1-Sept. 1		Nov. 20-Oct. 1	Jan. 1-Sept. 1	Jan, 1-Sept. 1	Jan. 1-Sept. 1
47	Virginia	Jan. 1-Oct. 1			Local laws	Feb. 1-Nov. 1	Feb. 1-Nov. 1	Feb. 1-Nov. 1	Local laws	Feb. 1-Nov. 1	April 1-Oct. 15 [10]	Jan. 1-July 20
48	Washington	Dec. 15-Sept. 15	Nov. 1-Sept. 15			Jan. 1-Oct. 1	Jan. 1-Sept. 1		Oct. 15, 1906		Mar. 1-Sept. 1	Mar. 1-Aug. 15
49	West Virginia	Dec. 15-Oct. 15		Jan. 1-Sept. 15	Jan. 1-Sept. 15	Dec. 20-Nov. 1	Dec. 15-Oct. 15	Dec. 15-Oct. 15		Nov. 2-July 15	April 1-Oct. 1	
50	Wisconsin	Dec. 1-Nov. 11 [12]		Mar. 1-Sept. 1	May 1-Sept. 1	To Sept. 1, 1905	Dec. 1-Sept. 1		Sept. 1, 1905	Dec. 1-Sept. 1	Jan. 1-Sept. 1	Dec. 1-Sept. 1
51	Wyoming	Nov. 15-Sept. 15	Nov. 15-Sept. 15 [1]			At all times	Oct. 15-July 15 [4]		Sept. 1, 1906		May 1-Sept. 1	May 1-Sept. 1

1 Elk only. 2 Moose and caribou, Oct. 15, 1905. 3 Grouse. 4 Prairie chicken—Minnesota, Nov. 1–Sept. 1; Missouri, Dec. 1–Sept. 1; Wyoming, Dec. 1–Sept. 1. 5 Snipe—New Hampshire, Dec. 15–Sept. 15; Connecticut, May 1–Aug. 1; Nebraska, April 16–Sept. 1. 6 Elk, to Sept. 15, 1904. 7 Antelope—Nebraska, Nov. 16–Aug. 15; Nevada, Nov. 15–Sept. 15. 8 In 20 counties to March 18, 1906. 9 Except crested quail. 10 Certain species. 11 Local Laws. 12 Local exceptions. 13 First two Wednesdays and first two Fridays after first Tuesday in November. 14 Except some counties where local laws govern. Prohibitory laws against hunting doves and robins exist in nearly all states. Sale of game during close season is prohibited in most states. License fees from non-residents required in some states. In most states female deer and elk and deer without horns protected at all times.

GAME LAWS

GAMES, a name of certain sports or amusements carried on under regular rules and methods, as with cards or dice, billiards, baseball, tennis, etc. Among the ancients there were public games or sports, exhibited on solemn occasions, in which various kinds of contests were introduced. The Grecian games were national festivals attended by spectators and competitors from all parts of Greece, the chief being the Olympic, Pythian, Nemean, and Isthmian. They consisted of chariot races, running, wrestling, and boxing matches, etc., and to be victorious in one of these contests was esteemed one of the highest honors of a Greek citizen. The Roman games were held chiefly at the festivals of the gods. They might, however, be exhibited by private persons to please the people, as the combats of gladiators, theatrical representations, combats of wild beasts in the amphitheater, etc.

GAM'UT, or **GAMMUT,** in music, the entire series of musical tones in the natural order of ascent or descent. With the musicians of the 11th century A represented the lowest note in their instruments, and a lower note having been introduced, the Greek gamma (Γ) was taken to represent it. From its prominent place as first note of the scale its name was taken to represent the whole.

GANDO, a kingdom of the Western Soudan, intersected by the Niger, and inhabited chiefly by Fellatahs, with a capital of some name. It is most fertile, and has a population of perhaps 5,000,000 Mohammedanism is the prevalent religion. The territory is now partly British, partly French.

GANESA (ga-nā'sa), an Indian god, the son of Siva and Pârvati, represented

Ganesa.

by a figure half man half elephant, having an elephant's head.

GANGA, in Hindu mythology, the personified goddess of the river Ganges.

GANGES (gan'jez), a river of Hindustan, one of the greatest rivers of Asia, rising in the Himalaya Mountains, in Garhwal state, and formed by the junction of two head streams, the Bhagirathi and the Alaknanda, which unite at Deoprag, 10 miles below Srinagar, 1500 feet above sea level. The Bhagirathi, as being a sacred stream, is usually considered the source of the Ganges, rising at the height of 13,800 feet, but the Alaknanada flows further and brings a larger volume of water to the junction. In the rainy season the flat country of Bengal is overflowed to the extent of 100 miles in breadth, the water beginning to recede after the middle of August. The Ganges is navigable for boats of a large size nearly 1500 miles from its mouths and it forms a great channel for traffic. It is an imperative duty of the Hindus to bathe in the Ganges, or at least to wash themselves with its waters, and to distribute alms, on certain days. The Hindus believe that whoever dies on its banks, and drinks of its waters before death, is exempted from the necessity of returning into this world and commencing a new life. The sick are therefore carried to the bank of the Ganges, and its waters is a considerable article of commerce in the remoter parts of India.

GANGES CANAL, Upper, a lateral canal in Northern India (N. W. Provinces), constructed for purposes of irrigation and supplementary navigation, extending on the right of the Ganges from Hardwar to Cawnpore. The trunk of the canal measures 445 miles. The Lower Ganges Canal is a sort of continuation of the Upper, intended for irrigation purposes.

GANG'LION, in anat. an enlargement occurring somewhere in the course of a nerve, and containing nerve cells in addition to nerve filaments. There are two systems of nerves which have ganglia upon them. First, those of common sensation, whose ganglia are near to the origin of the nerve in the spinal cord. Secondly, the great sympathetic nerve, which has ganglia on various parts of it. In the invertebrates ganglia are centers of nervous force, and are distributed through the body in pairs, one for each ring of the body, connected by fibers as in the figure. The cerebral ganglia of vertebrates are the brain itself, the masses of gray matter at the base of the brain, as the optic thalamus, etc.

GANGPUR', a native state of Bengal, in Chota Nagpur, consisting mainly of hills, forest, and jungle; area, 2484 sq. miles; pop. 107,965.

GANGRENE (gang'grēn), the death of some part of a living body, wherein the tissues begin to be in a state of mortification, there being also complete insensibility. A gangrened part must be removed either by amputation or by natural process, but if a vital part is so affected death will ensue.

GANGWAY, a narrow platform or bridge of planks along the upper part of a ship's side for communication fore and aft; also a sort of platform by which persons enter and leave a vessel.

GANJAM, a decayed town of India, in the Madras Presidency, formerly capital in the district of same name, near the coast of the Bay of Bengal. The district, one of the five Circars, is one of the most productive under the Madras Presidency, yielding rice, cotton, sugar, rum, and pulse, etc. Area, 8313 sq. miles; pop. 1,896,803.

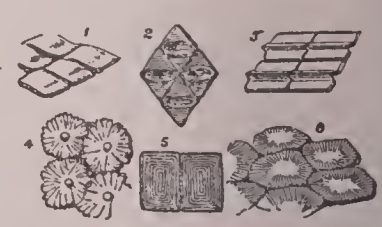
GANNET, the solan goose, is about 3 feet in length, and 6 in breadth of wings from tip to tip; the whole plumage, a dirty white, inclining to gray; the eyes, a pale yellow, surrounded with a naked skin of a fine blue color; the bill straight, 6 inches long, and furnished beneath with a kind of pouch. The gannets are birds of passage, arriving in Great Britain about March and departing in August or September, their move-

Gannet or solan goose.

ments being partially determined by those of the herring, on which they feed. They migrate to the southward in the winter, and appear on the coast of Portugal. In the breeding season they retire to high rocks on unfrequented islands—the Hebrides, Orkneys, St. Kilda, Ailsa Craig, and the Bass Rock. The nests are generally formed of seaweed. The female lays only one egg, though, if it be removed, she will deposit another. The young, which are much darker than the old birds, remain in the nest until nearly their full size, becoming extremely fat. In St. Kilda they form part of the food of the inhabitants, being taken by men lowered from the top of the cliffs.

GANNETT, Henry, an American geographer, was born in Bath, Maine, in 1846. In 1882 he became chief topographer of the U. States geological survey. He contributed much of the geographical matter to the present edition of the New International Encyclopædia. His publications include: A Manual of Topographic Methods; Dictionary of Altitudes; and Building of a Nation.

GAN'OIDS, the second order of fishes according to Agassiz. The families of this order are chiefly characterized by angular, rhomboidal, polygonal, or circular scales composed of horny or bony



Scales of ganoid fishes.
1, Lepidosteus. 2, Cheiracanthus. 3, Palæoniscus. 4, Cephalaspis. 5, Dipterus. 6, Acipenser.

plates covered with a thick plate of glossy enamel-like substance. The ganoids were most numerous in Palæozoic and early Mesozoic times, but are now represented by seven genera.

GAN'YMEDE (-mēd), in Grecian mythology, great-grandson of Dardanus, the founder of Troy, and son of Tros and of Callirrhoë, daughter of Scamander. Zeus sent his eagle to carry him off from Mount Ida to Olympus, where he held the office of cup-bearer to the immortals in succession to Hebe.

GAPES, a disease of fowls and other Rasorial birds, arising from the presence in the windpipe of small parasitic worms which cause the bird to continually open its beak. They may be dislodged with an oiled feather, or by mixing a little epsom salts with the food.

Ganymede and the Eagle—Museo Nazionale, Naples.

GARCILASO DE LA VEGA, called the prince of Spanish poets, born at Toledo in 1500 or 1503. His name is associated with that of his contemporary Boscan in the impetus given to Spanish literature by the imitation of the Italian poetic style as exemplified in Petrarch, Aristo and Sannazaro. His works, which consist of eclogues, epistles, odes, songs, sonnets, etc., are graceful and musical. He died in 1536.

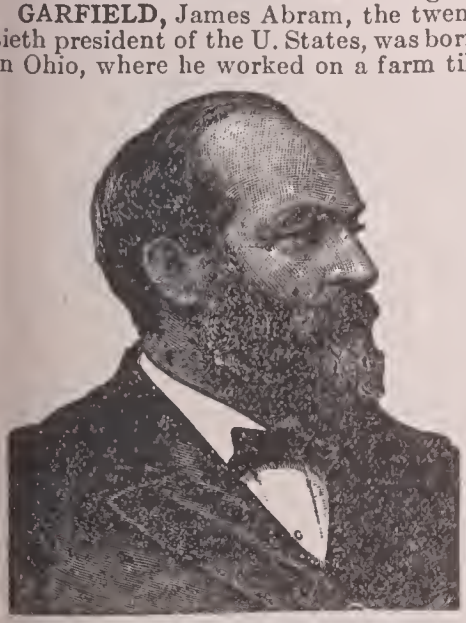
GARD (gär), a department of southern France, abutting on the Gulf of Lyons; area, 2256 sq. miles. Pop. 417,099.

GARDE NATIONALE (nâ-syo-nâl), a guard of armed citizens instituted at Paris, July 13, 1789, for the purpose of preserving order and protecting liberty.

GARDENING. See Horticulture.

GARDNER-GUN. See Machine-gun.

GARFIELD, James Abram, the twentieth president of the U. States, was born in Ohio, where he worked on a farm till



James A. Garfield.

his fourteenth year. He acquired a good education, however, studied law, and in 1859 was elected to the Ohio state senate. In 1861 he entered the army, was appointed colonel, became chief of staff to Rosecranz, and major-general of volunteers. He resigned his command on his election to congress in 1863. He sat in nine congresses for the same constituency, serving on important committees and winning ground no less by strong intelligence than uncompromising honesty. In 1880 he was elected to the senate, and in the same year became president of the U. States. Many reforms seemed about to be inaugurated, when he was shot by a disappointed office-seeker named Guiteau in the railway station at Washington. He lingered eighty days, dying at Long Branch, Sept. 19, 1881.

GAR-FISH, SEA-PIKE, or **GAR-PIKE,** a fish, known also as the sea-needle, making its appearance on the American coasts in summer, a short time before the mackerel.

GAR'GARA, the highest mountain of the ridge of Ida, in Asia Minor, near the Gulf of Adramyti, on the north.

GARGLE, a liquid application to the throat. In using a gargle the head should be thrown well back so as to keep the liquid in contact with the throat, and by expelling the air from the lungs through the liquid the passage may be thoroughly washed. Care should be taken not to swallow the gargle.

GAR'GOYLE, in Gothic architecture, a projecting spout, for throwing the

Gargoyle, Stony-Stratford.

water from the gutter of a building, usually of some grotesque form, such as the head or figure of an animal or monster.

GAR'HWAL (gar-hwäl'), or **GURHWAL,** a district of India, in the United Provinces, bounded on the north by Tibet, east by Kumaun, south by Bijnaur district, and west by the Garhwal state; area, 5500 sq. miles; pop. 407,818. There are good roads, and a considerable trade with Tibet.

GARHWAL, or **TEHRI,** a native Indian state under British protection, west of the district of the same name (see above); area, 4164 sq. miles; pop. 241,242. Chief town, Tehri; chief river, the Alaknanda and other head-waters of the Ganges.

GARIBAL'DI, Giuseppe, Italian patriot and hero, was born at Nice, 1807 his father being a poor fisherman. In 1834 he became a member of the "Young Italy" party, and being condemned to death for his share in the schemes of Mazzini, escaped to Marseilles, took service in the fleet of the Bey of Tunis and finally went to South America. In 1848 he returned to Italy, raised a band of volunteers, and harassed the Austrians until the cessation of hostilities and re-establishment of Austrian supremacy in Lombardy. He then retired to Switzerland, but in the spring of 1849 proceeded to Rome to support Mazzini's republic. He was appointed to command the

Giuseppe Garibaldi.

forces, but the odds were overwhelming, and after a desperate defense of thirty days Garibaldi escaped from Rome with 4000 of his followers. He then purchased a part of the small island of Caprera, on the north coast of Sardinia, and made this his home for the rest of his life. Latterly the subscriptions of his admirers enabled him to become owner of the whole island. In the war of 1859, in which Sardinia recovered Lombardy, Garibaldi and his chasseurs of the Alps did splendid service; and on the revolt of the Sicilians in 1860 he crossed to the island, wrested it after a fierce struggle from the King of Naples, recrossed to the mainland and occupied Naples, where he was procliamed dictator of the Two Sicilies. It was now feared that Garibaldi might prove untrue to his motto—Italy and Victor Emmanuel—but he really acquiesced in the annexation of the Two Sicilies to Italy, and declining all honors retired to his island farm. In 1864 he received an enthusiastic welcome in Britain. In 1870 he gave his services to the French republican government against the Germans, and with his 20,000 men rendered valuable assistance in the southeast. At the end of the war he was elected a member of the French assembly, but speedily resigned his seat and returned to Caprera. Rome now became the capital of the united Italy, and here in January, 1875, Garibaldi took his seat in the Italian parliament. The latter part of his life was spent quietly at Caprera. After 1870 he wrote two or three novels—very mediocre productions. He died somewhat suddenly June 2, 1882. His autobiography has been published in English.

GAR'LAND, Augustus Hill, American politician, was born in Tipton county, Tenn., in 1832, but when less than a year old was taken by his parents to Arkansas. He was elected to the provisional congress of the confederate states in 1861; was re-elected to the house of the same congress in 1862, and was afterward elected to the confederate senate, of which he continued to be a member until the close of the war. He then devoted himself to his profession

and in 1874 was elected governor of Arkansas, under the new constitution. He was a member of the U. States senate from 1877 to 1885, and from 1885 to 1889 was attorney-general of the U. States in the cabinet of President Cleveland, after which, until his death, in 1899, he practiced law in Washington, D. C.

GARLIC, a hardy, perennial allied to the onion, indigenous to the south of Europe, and forming a favorable condiment among several nations. The leaves are grass-like, and differ from those of the common onion in not being fistulous; the stem is about 2 feet high; the flowers are white; and the root is a compound bulb, consisting of several smaller bulbs, commonly denominated cloves, enveloped by a common membrane. It has a strong, penetrating odor, and a pungent acrid taste. Used as a medicine it is stimulent, tonic, and promotes digestion; it has also diuretic and sudorific qualities, and is a good expectorant.—Oil of garlic is a sulphide of allyl, a colorless, strongly-smelling oil, exceedingly irritant to the palate and the skin. It is contained also in the onion, leek, asafœtida, etc.

GARNET, a beautiful mineral, or group of minerals, classed among the gems, and occurring generally in mica-slate, hornblende-slate, gneiss, and granite, usually as more or less regular crystals of from twelve to sixty or even eighty-four sides. The prevailing color is red of various shades, but often brown and sometimes green, yellow, or black. They vary considerably in composition, but admit of classification into three principal groups according to their chief sesquioxide basic components, viz. alumina, iron, and chrome garnets. Among the varieties are common garnet, pyrope, alamandine, precious or oriental garnet, allochroite, melanite or black garnet, etc. By jewelers garnets are classed as Syrian, Bohemian, or Cinghalese, rather, however, from their relative value and fineness than as necessarily implying that they came from these places. The first, named after Syrian, in Pegu, long the chief mart for garnets, are the most esteemed, being a violet-purple unmixed with black and taking an orange tint by artificial light. The Bohemian garnet is usually a dull poppy red with hyacinth orange tint when held between the eye and the light; the pyrope is a full crimson form of this class. Coarse garnets reduced to powder are sometimes used in place of emery for polishing metals.

GARNISHMENT, a process by which chattels, rights, or credits belonging to the defendant in an action, but which are in the possession of a third person are seized and applied to the plaintiff's claim. It is not a common-law process and is regulated by statute in the states where it exists. Such statutes are, as a rule, strictly construed, and their requirements must be fully and fairly complied with by a plaintiff who would take advantage of them. It is held that only such property in the hands of the third party—the garnishee—is liable to this process as is not incumbered with trusts, and such as may be handed over or paid by the officer executing the process, under the order of the court and free from incumbrances, which can be properly determined and adjusted only by equity tribunals. Garnishment proceedings reach only such debts as are owing to the defendant at the time the process is served. A judgment obtained in a federal court cannot be garnisheed in an action in a state court. Such garnishment would operate to oust the federal court of its proper control over its own judgments.

GARONNE', a river of s.w. France, rising in the vale of Aran, in the Spanish Pyrenees; length, about 350 miles.

GARONNE, HAUTE, a department, south of France, one of the five separated by the Pyrenees from Spain. Capital of department, Toulouse. Area, 2,529 sq. miles. Pop. 439,769.

GARRICK, David, actor, born at Hereford, Eng., Feb. 20, 1717. He had a strong passion for acting, and in 1741 joined Giffard's company at Ipswich under the name of Lyddal. At Giffard's theater in Goodman's-fields he achieved a great success as Richard III., and in 1742 was not less successful at Drury Lane. In 1745 he became joint manager with Mr. Sheridan of a theater in Dublin, and after a season at Covent Garden (1746) purchased Drury Lane in conjunction with Mr. Lacy, opening it 15th September, 1747, with the Merchant of Venice, to which Dr. Johnson furnished a prologue. From this period may be dated a comparative revival of Shakespeare, and a reform both in the conduct and license of the drama. In 1763 he visited the Continent for a year and a half. He had already written his farces of The Lying Valet, Lethe, and Miss in her Teens; and in 1766 he composed, jointly with Colman, the excellent comedy of the Clandestine Marriage. After the death of Lacy, in 1773, the sole management of the theater devolved upon Garrick, until 1776, when he sold his moiety of the theater for £37,000, performed his last part, Don Felix in The Wonder, for the benefit of the theatrical fund, and bade an impressive farewell to the stage. He died January 20, 1779, and was buried with great pomp in Westminster Abbey.

GAR'RISON, William Lloyd, American journalist, and founder of the anti-slavery movement in the U. States, born 1805. He was apprenticed to a shoemaker, but eventually became a compositor on the Newburyport Herald. In 1827 he became editor of the National Philanthropist, the first American temperance journal, and afterward of a journal in support of the election of John Quincy Adams. With Mr. Lundy, a Quaker, he then started the paper called the Genius of Universal Emancipation (1829), his denunciations of slave-traders leading to his imprisonment for libel. On his release he commenced lecturing in Boston, started the Liberator (1831), published weekly with the aid of one assistant and a negro boy. In 1832 appeared his Thoughts on African Colonization, and in the same year he established the American anti-slavery society. He subsequently visited England, where he was welcomed by Wilberforce, Brougham, Buxton, and others. In 1835 he was saved with difficulty from a Boston mob; but his principles made steady progress until 1865, when the anti-slavery society was dissolved with its work accomplished. He died at New York, 1879. A volume of sonnets (1843) and one of selections (1852) bear his name.

GARROTE (gar-rō'tā), a mode of punishment in Spain by strangulation, the victim being placed on a stool with a post or stake (Spanish, garrote) behind, to which is affixed an iron collar with a screw; this collar is made to clasp the neck of the criminal, and drawn tighter by means of the screw till life becomes extinct. This word, with the French spelling and pronunciation garrote, has become naturalized in Great Britain as a term for a species of robbery effected by throttling the victim and stripping him while insensible.

GARTER, Order of the, the highest and most ancient order of knighthood in Great Britain. The origin of the order, though sometimes assigned to Richard I., is generally attributed to Edward III., the legend being that Countess of

Insignia of the garter.

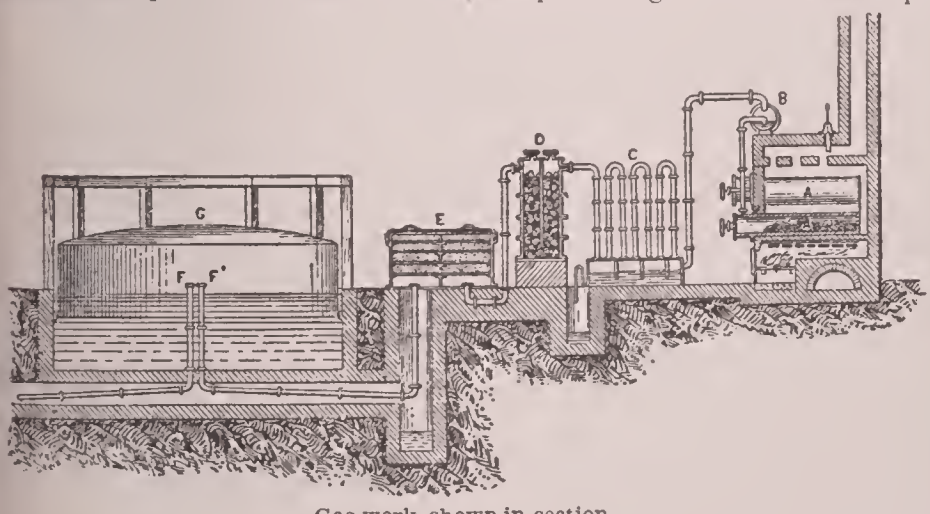
Salisbury having dropped her garter while dancing, the king restored it, after putting it round his own leg, with the words, which became the motto of the order, "Honi soit qui mal y pense"—Shame be to him who thinks evil of it. The date of the foundation or restoration by Edward III. of the order, as given by Froissart, is 1344, while other authorities, founding on the statutes of the order, assign it to 1350. The statutes of the order have been repeatedly revised, more particularly in the reigns of Henry V., Henry VIII., Edward VI., and George III.—the last in 1805. Ladies are said to have been admitted up till the reign of Edward IV. Until the reign of Edward VI. the common title of the order was the Order of St. George, and it still bears this title, as well as that of the Garter. The original number of knights was twenty-six, including the sovereign, who was its permanent head; and this number is still retained, except that by a statute passed in 1786 princes of the blood are admitted as supernumerary members. The peculiar emblem of the order, the garter (5), a dark-blue ribbon edged with gold, bearing the motto and with a gold buckle and pendant, is worn on the left leg below the knee. The mantle is of blue velvet, lined

with white taffeta, the surcoat and hood of crimson velvet, the hat of black velvet with plume of white ostrich feathers, having it the center a tuft of black heron's feathers. The collar of gold (3) consists of knots alternating with garters inclosing roses, with the badge of the order, called the George (4), pendent from it. This consists of a figure of St. George on horseback fighting the dragon. The lesser George (2) is worn on a broad blue ribbon over the left shoulder. The star (1), formerly only a cross, is of silver, and consists of eight points, with the cross of St. George in the center, encircled by the garter. A star is worn by the knights on the left side when not in the dress of the order.

GARTER-SNAKE, an elastic name given in North America to any of various small snakes, but properly applied to striped species, which includes those most often seen of all our serpents. Several of these are very slender, mainly green with lighter stripes, and are popularly distinguished as ribbon-snakes. One Oregon species is black, and some semi-tropical species have the stripes broken so as to form series of spots or cross-bars. The best-known species is the ordinary garter-snake, which is distributed over the whole U. States, Southern Canada, and the lowlands of Mexico and Guatemala.

GARY, IND., founded in 1906 on Lake Michigan at the mouth of the Calumet river near Chicago. The town was made to order as the home of a $75,000,000 plant for the United States steel corporation. Estimated population, 40,000.

GAS, an elastic aeriform fluid, a term originally synonymous with air, but afterward restricted to such bodies as were supposed to be incapable of being reduced to a liquid or solid state. Under this supposition gas was "a term applied to all permanently elastic fluids or airs differing from common air." After the liquefaction of gases by Faraday, the old distinction between gas and vapor, viz. that the latter could be reduced to a liquid or solid condition by reduction of temperature and increase of pressure, while a gas could not be so altered, was no longer tenable, so that the term has resumed nearly its original signification, and designates any substance in an elastic aeriform state. Gases are distinguished from liquids by the name of elastic fluids; while liquids are termed non-elastic, because they have, comparatively, no elasticity. But the most prominent distinction is the following:—Liquids are compressible to a certain degree, and expand into their former state when the pressure is removed; and in so far they are elastic, but gases appear to be in a continued state of compression, for when left unconfined they expand in every direction to an extent which has not hitherto been determined. In respect of this indefinite expansiveness, all gaseous bodies obey more or less strictly two laws, commonly called the "gaseous laws." The first, known as the law of Boyle and Mariotte, given first by Robert Boyle in 1662, and then by Mariotte in 1676, is that:—The volume of a given mass of gas varies inversely with the pressure to which the gas is subjected; or, in other words, the density of a given mass of gas is in direct proportion to the pressure that the gas is subjected to. The second of the gaseous laws is commonly called the law of Dalton and Gay-Lussac. It is, however, properly called Charles' law. Dalton published it in 1801; but Gay-Lussac, who stated it in 1802, gives the credit of having discovered it, fifteen years previously, to Citizen Charles. The law may be stated as follows:—The volume of a gas maintained under constant pressure increases for equal increments of temperature by a constant fraction of its original volume; and this fraction is the same whatever is the nature of the gas. A mass of gas, whose volume is 1000 at 0° C., becomes, at 100° C., 1366·5, the pressure remaining constant. In virtue of these laws a gas may now be defined to be a substance possessing the condition of perfect fluid elasticity, and presenting under a constant pressure a uniform state of expansion for equal increments of temperature—a property distinguishing it from vapor. There is, however, no known gas that obeys these two laws perfectly: thus, of the six gases whose liquefaction has been attended with most difficulty (oxygen, hydrogen, nitrogen, carbonic oxide, nitric oxide, and light carburetted hydrogen), all except hydrogen are more compressible than they should be theoretically, while hydrogen deviates slightly in the opposite direction, being less compressible than Boyle's law would indicate. The other gases exhibit even greater deviations from Boyle's law, and the amount of the deviation rapidly increases as the gas is brought nearer and nearer to liquefaction. The law of Dalton or Charles which gives for equal elevation of temperature equal increments of volume is also deviated from by every gas, and more and more so as the point of liquefaction is approached.



Gas-work, shown in section.

The liquefaction of gases is effected by the application of cold or pressure, or both combined. For any given pressure there is a particular temperature at which the gas liquefies. At a certain point, however, called by Andrews the critical point of temperature, the distinction between liquid and gas appears completely lost. At and above this temperature no pressure that can be applied will convert the fluid into the form of a liquid even though the volume is diminished by pressure so much as to make the density of the fluid greater than that of the liquid obtained at lower temperatures. By 1878 all gases had been liquefied.

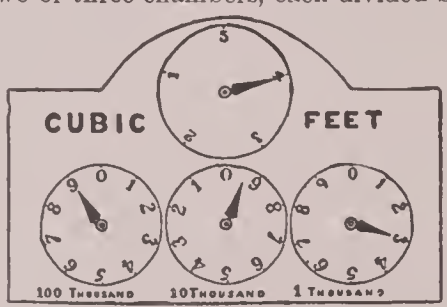
The power of motion inherent in all parts of aeriform matter is accounted for by the kinetic theory of gases, according to which a gas consists of an enormous number of molecules moving about with very great velocity. Great as is their number, however, the molecules are sparsely distributed through space, in comparison with their distribution when the substance is in the solid or liquid condition. A molecule of a gas flying about moves on in a stright line till it meets another molecule, or till it impinges on a side of the containing vessel. Meeting another molecule the two turn each other aside, just as two billiard balls when they come into collision are both deflected from their previous paths. Passing thence each flies on in a straight line till it meets a fresh molecule, and each is again deflected. When the molecules impinge on the side of the vessel that contains the gas they rebound as a billiard ball does from the cushion of the billiard table; and the perpetual shower of molecules that strike and rebound from the sides gives rise to the phenomenon of gaseous pressure, just as an umbrella held out in a hail-storm is pressed downward owing to the numerous impulsive blows that act upon it. When the temperature of a gas is raised the energy of the molecules is increased. They strike with greater velocity, and the number of blows on the side of the vessel is also increased. The pressure is therefore greater; and the law of Dalton or Charles is easily shown to be a consequence of the kinetic theory. Boyle's law also follows very simply from it; for if we diminish the volume of the containing vessel to one-half, one-third, or to any other fraction of its original volume, we increase the number of molecules in a given space, a cubic inch for instance, in the same ratio. Consequently the number of impacts on a square inch of the surface of the containing vessel will also be increased in the same ratio, and the pressure will thus be increased in that ratio too. It is estimated that in a cubic centimeter of gas at standard temperature and pressure there

are nineteen million million million molecules.

In 1739 the Rev. Mr. Clayton published a paper in the Philosophical Transactions, on the inflammable nature of the gases obtained by the decomposition of pit-coal in heated close vessels; but no practical application of this discovery was made before 1792, when Mr. W. Murdoch, a native of Ayrshire, in the employ of Messrs. Watt and Boulton, lighted his own house and offices at Redruth on this principle. In 1798 he erected a gas apparatus on a large scale at Soho Foundry, Birmingham, and in 1802 M Le Bon lighted his house in Paris by gas, and made a proposal to supply the whole city. In 1803 Mr. Winsor exhibited gas illuminations at London in the Lyceum, and afterward raised the sum of $250,000 from a number of subscribers who formed themselves into a National Light and Heat Company (1810). With this money Mr. Winsor lighted Pall Mall, but was soon succeeded by Mr. Samuel Gleg, who invented the hydraulic main, the wet-lime purifier, and the wet gas-meter. From this time coal gas became the most common illuminating agent wherever it could be prepared economically.

Gas is obtained from coal, the best sorts being bituminous coals. The coal is distilled in retorts of cast-iron (a), or now more generally of fire-clay, heated to a bright red heat. As they issue from the retort into the hydraulic main (b) the products of distillation contain vapors of tar and naptha, together with steam impregnated with carbonate of ammonia and hydrosulphate of sulphide of ammonium. These vapors would condense in the pipes in which the gas must be distributed, and would clog them up; they must therefore be so far removed by previous cooling as to cause no inconvenient condensation at ordinary temperatures. The crude gas contains, besides, sulphuretted hydrogen, the combustion of which would exhale an offensive odor. Carbonic acid weakens the illuminating power of the gas, and has also to be removed. In the hydraulic main—a large horizontal pipe at first about half-filled with water—some separation is effected between the liquid products of distillation and the gaseous, which bubble up through the liquid into the upper portion of the main. At the end of the main the liquids fall by their greater gravity into the sunk reservoir known as the tar-well, while the gas is conducted to the condenser or refrigerator (c), a series of bent iron tubes kept cool either by exposure to currents of air or by allowing water to flow over them. In these there is a further deposit of tar and water, and the gas passes on to the washer, a series of cells in which the gas is forced through water or exposed to water spray for the removal of ammonia. The scrubber (d), which is sometimes used in place of the washer, is a large chamber filled with coke kept constantly wet with sprays of water. The gas in passing up the scrubber leaves its last traces of ammonia and its compounds, and then enters the purifiers (e), which are iron chambers containing a series of perforated trays on which are spread slaked lime (in the form of dry hydrate), or a mixture of sawdust and oxide of iron. These remove carbonic acid and the greater portion of the sulphur compounds, and the gas is then conveyed by means of a pipe (f) to the gas-holder (g) a store-house or reservoir, in which it is subjected to uniform pressure, and from which it is discharged (f) into the street or other mains in the constant stream necessary to produce a steady flame from the burners in the houses of those using it. The gas-holder, sometimes called a gasometer, is usually a very large cylindrical air-tight structure of iron plates, closed at top, open below, and having the lower end immersed in a water reservoir. It is supported by chains passing over pulleys on iron columns, the greater part of the weight of the gas-holder being counterbalanced by weights attached to the chains, so that it can exercise a certain regulated pressure on the gas contained in it.

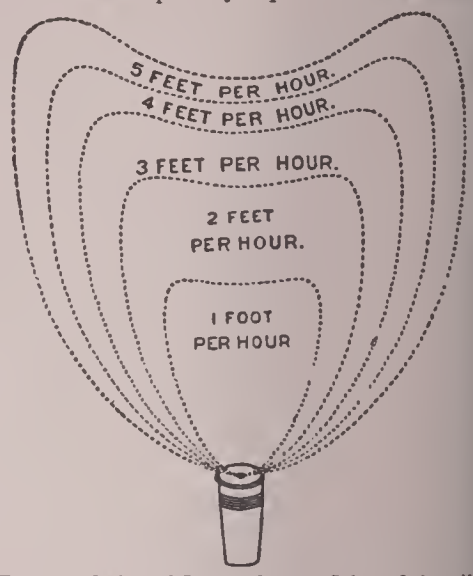
The quantity of gas used by each consumer is measured by an instrument called a meter, of which there are two classes—the wet and the dry. The wet meter is composed of an outer box about three-fifths filled with water. Within this is a revolving four-chambered drum, each chamber being capable of containing a definite quantity of gas, which is admitted through a pipe in the center of the meter, and, owing to the arrangement of the partitions of the chambers, causes the drum to maintain a constant revolution. This sets in motion a train of wheels carrying the hands over the dials which mark the quantity of gas consumed. The dry meter consists of two or three chambers, each divided by



The index of a dry meter.

a flexible partition or diaphragm, by the motion of which the capacity on one side is diminished while that on the other is increased. By means of slide-valves, like those of a steam-engine, worked by the movement of the diaphragms, the gas to be measured passes alternately in and out of each space. The contractions and expansions set in motion in clockwork which marks the rate of consumption. The diaphragms in all the chambers are so connected that they move in concert.

The profitable consumption of gas, whereby the strongest light can be had at the least expenditure of gas, depends considerably upon the form of the burner, and the mode by which the flame is fed with the air necessary for its combustion. There must be a sufficient supply of oxygen to convert the carbon of the gas into carbonic acid, and the hydrogen into water. If there is not a sufficient supply of oxygen, the flame will be smoky from excess of carbon. In this case the remedy is either to reduce the supply of gas or increase the supply of air. This may be effected by modifying the form of the burner, or in the case of the Argand burner by having a different shape of glass chimney. As to the form of the burner, it has been found that a plain jet ¼ inch in diameter



Form and size of flames from a 5-foot fish-tail, lava-tip burner.

at the orifice, will not give a flame free from smoke of a greater height than 2½ inches; but the same quantity of gas which would give a smoky flame from a plain jet, will produce a clear bright flame by extending or dividing the aperture of the jet so as to expose a larger surface of flame to the atmosphere. It is not, however, necessary to increase the superficial area of the flame; it may even be diminished with a more intensely luminous effect by having instead of one aperture two small ones pierced at an angle to each other, so that the jets may cross each other. This forms the union jet. Another form is the slit or batwing burner, in which a clean slit is cut across the top of the beak. In the Argand burner a circle of small holes supplies the gas, and a current of air is admitted through the center of the flame, which is surrounded by a glass chimney. In the Welsbach incandescent lamp the light is produced by causing the burning gas to raise to white heat what is known as the mantle, suspended over the burner. The mantle consists essentially of cotton yarn steeped in a solution of salts of such metals as thorium, cerium, yttrium, lanthanum, magnesium, etc., and when the thread has been burned away there remains a skeleton of the oxides of the metals used.

GAS'CONY, an old division of France, between the Garonne, the sea, and the Pyrénées. It composes the departments of Hautes Pyrénées, Gers, and Landes, with part of those of Bas Pyrénées, Haute Garonne, Lot-et-Garonne, and Tarn-et-Garonne. The Gascons, who are of mixed Basque and Gothic descent, used to have the character of being brave, faithful, and peculiarly tenacious of purpose, but much given to boasting, whence the word gasconnade.

GAS ENGINE, an engine in which the movement of the piston is caused by the explosive energy of a mixture of in-

THE GASOLINE MOTOR.

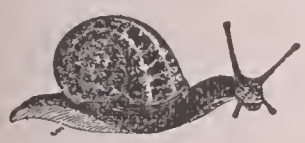
The latest invention in railroads is the motor coach, of which 33 were installed on the Union Pacific Railroad in 1907. The power employed is gasoline and the engine transmits its power directly to the engine. The cars are 55 feet long, weigh 58,000 pounds and are equipped with a 200-horse power engine with a seating capacity of 75 passengers and a speed of a mile a minute. The wedge-shaped front end offers only one-fourth the resistance of a car with a flat end. The body of the car is built wholly of steel, with a semi-elliptical roof, and practically indestructible. The round windows give an absolutely water and dust proof window. The lighting is electric, an individual lamp being over each seat.

flammable gas with atmospheric air. After various attempts by Huyghens, Pepin, and others to utilize explosive agents like gunpowder in working machines, a French artisan, Lebon, patented in 1799 an engine in which energy was obtained by exploding charges of coal-gas mixed with air on each side of the piston alternately, the explosion being effected by an electric spark. Modifications of this engine were patented by Lenoir in 1860, by Hugon, and by Messrs. Siemens. The most satisfactory are probably those known as Brayton's high-pressure gas engine, and Otto's gas engine. The latter consists of an upright cylinder in which works a heavy piston, the rod of which forms a rack-gearing with a cog-wheel on the shaft of the fly-wheel. As the piston ascends the cog-wheel slips loosely on the shaft; as it descends its energy is transferred to the shaft through the cog-wheel, the force of the down-stroke being due to the rapid condensation of the gases after the explosion aided by the weight of the piston itself. The mixed gases—coal-gas and air—are introduced at the base of the cylinder and fired, as in Hugon's patent, by communication with a gas-jet kept constantly burning. The great objection to this engine—its noise in working—has been overcome in the Otto silent gas engine, in which the working cylinder is horizontal and considerably shorter than in the old form.

GAS'KELL, Elizabeth Cleghorn, novelist, daughter of William Stevenson, editor of Scott's Magazine, born at Chelsea in 1810. In 1857 appeared her admirable Life of Charlotte Brontë, and in 1860 Sylvia's Lovers. Wives and Daughters appeared posthumously in 1866. The work that she is best known by is Cranford, a delightful story of village life, classed by literary critics as one of the classics.

GASKETS, cords fastened to the sail-yards of a ship, and used to furl or tie up the sail firmly to the yard by wrapping round both.

GAS'TEROPODS, a class of molluscs, consisting of animals inhabiting a univalve shell, although some of the group are wholly destitute of a shell. The shell



A gasteropod.
Common garden-snail. *f*, Foot extending the whole length of the under side of the body.

is either a small internal plate, as in slugs; or cone-shaped and spiral, as in the majority; or multivalve, the pieces following each other along the middle line, as in the chitons. No known gasteropod has a bivalve shell. The distinguishing characteristic is the foot, which is broad, muscular, and disc-like, and attached to the ventral surface. The class is divided into two sub-classes, the Branchiata or Branchiogasteropoda, breathing water by gills, and the Pulmonata or Pulmogasteropoda, breathing air by a sort of lung apparatus. The former includes whelks and periwinkles, etc.; the latter include the ordinary land-snails, slugs, pond-snails, etc.

GASTON DE FOIX (fwà), Duke of Nemours, French soldier, born 1489, son of John de Foix, count d'Estampes, and Mary of Orleans, sister of Louis XII., whose favorite he became. At the age of twenty-three he routed a Swiss army rapidly crossed four rivers, drove the pope from Bologna, and won the celebrated battle of Ravenna (1512), but was killed while attempting to cut off a body of retreating Spaniards.

GASTRIC JUICE, a clear colorless fluid with a saline taste and sour odor secreted by the mucous membrane of the stomach, and chief agent in the process of digestion. It is acid, and contains pepsin, its essential nitrogenous principle. The activity of the fluid has been ascribed to various acids present, lactic, acetic, and butyric; but it appears that free hydrochloric acid is that which is secreted by the stomach, the others being the products of change of food undergoing digestion. The acid is necessary for the pepsin to exercise its properties, which are limited to the conversion of nitrogenous substances into peptones, fatty matters not being affected by it. (See Pepsin.) Gastric juice also holds in solution various inorganic salts, chiefly chlorides and phosphates, occasionally also abnormal substances such as urea, ammonia, salts, and biliary acids. It is not possessed of any marked reactions with ordinary chemical reagents, does not become turpid by boiling, and gives no striking precipitates with acids, alkalies, or mineral salts. The amount secreted daily in the human adult is estimated to be about 14 pounds, but as it is continually re-absorbed, there is no great quantity present at any one time.

GASTRIC SYSTEM, all the parts of the body which contribute to digestion.

GASTRI'TIS, or **GASTRO-ENTERITIS.** See Enteritis.

GASTROCNE'MIUS, the most external of three superficial muscles forming the calf of the leg and terminating above the heel in the tendo Achillis.

GATES, Horatio, an American officer during the revolutionary war, born in England in 1728. He rose to the rank of major by merit alone. At the capture of Martinique he was aide-de-camp to General Monkton, and he was with

General Gates.

Braddock when the latter was defeated in 1755. On the conclusion of peace he purchased an estate in Virginia, on which he resided until the revolutionary war in 1775, when he was appointed adjutant-general by congress, with the rank of brigadier. At the head of the American army of the north he compelled the British general Burgoyne to surrender his whole army at Saratoga (1777). In 1780, after the capture of General Lincoln, Gates received the chief command of the southern districts, but was defeated two months later by Cornwallis at Camden. He was then superseded by General Greene and brought to court-martial, but was finally acquitted, and reinstated in his command in 1782 after the capture of Cornwallis. He then retired to Virginia, and in 1790, having emancipated all his slaves, he removed to New York, where he died in 1806.

GATESHEAD, mun., county, and parliamentary borough, England, county Durham, on the right bank of the Tyne, opposite Newcastle, of which it is practically part, being connected with it by three bridges. Pop. 109,887.

GATH (Hebrew, "wine-press"), one of the five royal cities of the Philistines, which, from its situation on the borders of Judah, was of much importance in the wars of the Jews and Philistines.

GATLING-GUN. See Machine-gun.

GAUGE (or Gage), Steam and Water, the instruments fixed to engine boilers for registering the force of steam and the level of the water.

GAUGE, a standard of measurement. As applied to railways, gauge signifies the distance between the centers of each pair of rails, which in England and the United States or narrow gauge is 4 feet 8½ inches. The broad gauge is 7 feet; the Irish, Indian, and Spanish gauge is 5 feet 6 inches. Special narrow gauges have recently been adopted for mountain and mineral lines, such as the 3 feet 6 inch gauge of the Norwegian lines. Gauge is also the name applied to various contrivances for measuring any special dimensions, such as the wire-gauge, an oblong plate of steel, with notches of different widths cut on the edge and numbered, the size of the wire being determined by trying it in the different notches until one is found which it exactly fits. The thickness of sheet-metal is tried by a similar gauge.

GAUL, Gallia, in ancient geography, the country of the Gauls, the chief branch of the great original stock of Celts. It extended at one time from the Pyrenees to the Rhine, and included also a part of Italy. Hence it was divided into Gaul on this side (the Roman side) of the Alps, or Gallia Cisalpina, and Gaul beyond the Alps, or Gallia Transalpina.

More than a century after the burning of Rome, the eastern Gauls, in 280–278 B.C., made three destructive irruptions into Macedonia and Greece. Several tribes pursued their course into Asia Minor, where, under the name of Galatians, they long retained their national peculiarities. After these migrations the Gauls along the banks of the Danube and in the south of Germany disappear. Tribes of German origin occupy the whole country as far as the Rhine, and even beyond that river. The Belgæ, who were partly German, occupied the northern part of Gaul, from the Seine and Marne to the British Channel and the Rhine, from

whence colonists passed over into Britain, and settled on the coast districts. The Celts in Gaul had attained some degree of cultivation by intercourse with the Greeks and Carthaginians before they came in contact with the Romans. On the appointment of Julius Cæsar to the proconsulship over the countries bordering on Gaul, he resolved to subject all Gaul, and executed his purpose in less than nine years (58–50) (B.C.), in eight bloody campaigns. The dominion of the Romans in Gaul was confirmed by colonies, and the liberal grant of the Roman citizenship to several Gallic tribes. The religion of the Druids, being suppressed in Gaul by Tiberius and Claudius, gradually retreated into Britain, soon also conquered by the Romans. After the extinction of the Cæsars, the Gauls once more attempted to recover their liberty by aid of the Germans, but after this last effort became entirely Romanized, even their ancient language, the Celtic, being supplanted by a corrupt Latin dialect. About the year 486 the Franks subdued the greater part of Gaul, and put a period to the dominion of the Romans in that country. See France.

GAUSS (gous), Karl Friedrich, a German mathematician, born 1777. In 1801 he published his Disquisitiones Arithmeticæ, treating of indeterminate analysis or transcendental arithmetic, and containing, in addition to many new theroems,a demonstration of the theroem of Fermat concerning triangular numbers. He also calculated, by a new method, the orbit of the planets Ceres and Pallas. In 1807 he became professor of mathematics and director of the observatory at Göttingen, a position which he held till his death in 1855.

GAU'TAMA, a name of Buddha, the founder of Buddhism. See Buddha.

GAUTIER (gō-ti-ā), Théophile, French poet and critic, born 1811 at Tarbes (Hautes-Pyrénées). In 1832 appeared his poem Albertus; but his first great success was the romance Mademoiselle de Maupin, which led to his engagement by Balzac as secretary. In 1872 he was sent by the republican government on a literary mission to Italy, and died in the same year.

GAUZE, a thin transparent stuff of silk, linen, or cotton. It is either plain or figured, the latter being sometimes worked with flowers of silver or gold.

GA'VIAL, the Indian crocodile, characterized by the narrow, almost cylindrical jaws which form an exceedingly elongated muzzle. The teeth (about120

Head of gavial, or gangetic crocodile.

in number) are of equal length, and the feet are completely webbed. The males can be distinguished from the females by the shape of the muzzle, which is much smaller at the extremity. The only extant species occurs in South and Eastern Asia, especially in the Ganges. It feeds on fishes and small prey.

GAVOTTE', an air for a dance with two strains, each of four or eight bars, in $\frac{2}{4}$ or $\frac{4}{4}$ time, the starting notes occupying half a bar. Like the minuet, it has been introduced for free treatment into suites, sonatas, etc. The name is said to be derived from the Gavots, the inhabitants of the Gap, in France.

GAY, John, English poet, born near Barnstaple in 1688, and apprenticed to a silk mercer in London. In 1712 he became secretary to Anne, Duchess of Monmouth. In 1713 he published his Rural Sports, which he dedicated to Pope, with whom he formed a close friendship. In 1720 he published his poems by subscription, in 1724 his tragedy, The Captives, and in 1727 his well-known Fables. His Beggar's Opera, the notion of which seems to have been afforded by Swift, was first acted in 1728, at Lincoln's Inn Fields. He also wrote the pastoral Acis and Galatea and the opera Achilles. He died in 1732.

GAYA, the chief town of a district of the same name in Bengal, on the right bank of the Phalgu, a tributary of the Ganges, 260 miles n.w. of Calcutta. Pop. 71,288. The district has an area of 4712 sq. miles, and pop. 2,138,331.

GAY-LUSSAC (gā-lus-âk), Louis Joseph, French chemist and physicist, born at St. Léonard (Haute-Vienne) 1778, died at Paris 1850. He was educated in the Ecole Polytechnique from 1797 to 1800, and afterward in the Ecole des Ponts et Chaussées, but preferring chemistry, he entered Berthollet's Ecole Laboratory. In 1802 he returned to the Polytechnique as demonstrator of chemistry, and in 1804 performed his two balloon ascents for scientific purposes, the first with Biot, the second by himself, an account of which appeared in the Journal de Physique. In 1806 he was elected to the Academy of Sciences. He was especially celebrated for his researches into the chemical and physical properties of gases and vapors.

GAZELLE', the type of a sub-family of antelopes (Gazellinæ), which includes some 23 species of small, mostly desert-

Gazelles.

loving forms. Its color is a light fawn upon the back, deepening into dark-brown in a wide band which edges the flanks and forms a line of demarcation between the color of the upper portions of the body and the pure white of the abdomen. The eye of the gazelle is large, soft, and lustrous. Both sexes are provided with horns, round, black, and lyrated, about 13 inches long. It seems to be confined to the north side of the Atlas Mountains, Egypt, Abyssinia, Syria, Arabia, and South Persia.

GAZETTEER', a geographical dictionary; a book containing descriptions of natural and political divisions, countries, cities, towns, rivers, mountains etc., alphabetically arranged.

GAZ'OGENE, an apparatus used for manufacturing aerated water on a small scale for domestic use, by the combination of an alkali and an acid, as carbonate of soda and tartaric acid, which yield carbonic acid when mixed with water.

GEARING, in machinery, the parts collectively by which motion communicated to one portion of a machine is transmitted to another, generally a train of toothed wheels. There are two chief sorts of wheel gearing, viz.: spur-gearing and beveled gearing. In the former the teeth are arranged round either the concave or convex surface of a cylindrical wheel in the direction of radii from the center of the wheel, and are of equal depth throughout. In beveled gearing the teeth are placed upon a beveled surface round a wheel which if the slope of the bevel were continued would form a cone, the teeth sloping similarly.

GEBER (gē'bėr), Arabian chemist or alchemist, often designated the father of chemistry, flourished during the 8th century. He was acquainted with nearly all the chemical processes in use down to the 18th century. His writings describe various kinds of furnaces and other apparatus, and cupellation, distillation, and other chemical processes; the purification, composition, and properties of the metals then known—gold, silver, copper, lead, tin, and iron, and the functions of mercury, sulphur, and arsenic. He is the reputed author of an immense number of works as well on metaphysics, language, astronomy, etc., as on chemistry.

GED (ged), William, inventor of stereotyping, born in Edinburgh about the beginning of the 18th century, died in poor circumstances in 1749. He first practiced his great improvement in the art of printing in 1725; and some years later he entered into a partnership in London, the result of which was the production of two prayer-books only. He returned to Scotland in 1733, and published a stereotype edition of Sallust.

GEHEN'NA, a term used in the New Testament as equivalent to place of fire or torment, and rendered in the authorized (and the revised) version by hell and hell-fire.

GEIBEL (gī'bl), Emanuel, German poet, born at Lübeck 1815, died 1884. He wrote Brunhild, a tragedy; The Loreley, an opera in rhyme, and several other plays, but his fame rests on his lyrics, which are immensely popular.

GELATIN PROCESS, is used in many photographic and photo-mechanical processes as a vehicle for certain chemicals which either alone or in combination are sensitive to the action of light, and under its influence experience changes in their condition. The substitution of the gelatin film of the dry plate for the collodion surface of the wet plate was an important development in photography, while the fact that gelatin mixed with bichromate of potash becomes insoluble when acted

FAMOUS GEMS AND PRECIOUS STONES.

upon by light furnishes the basis for many photographic processes.

GELATINE (jel'a-tin), a concrete animal substance, transparent, and soluble slowly in cold water, but rapidly in warm water. It is confined to the solid parts of the body, such as tendons, ligaments, cartilages, and bones, and exists nearly pure in the skin, but it is not contained in any healthy animal fluid. Its leading character is the formation of a tremulous jelly when its solution in boiling water cools. Gelatine does not exist as such in the animal tissues, but is formed by the action of boiling water. The coarser forms of gelatine from hoofs, hides, etc., are called glue; that from skin and finer membranes is called size; and the purest gelatine, from the air-bladders and other membranes of fish, is called isinglass. With tannin a yellowish white precipitate is thrown down from a solution of gelatine, which forms an elastic adhesive mass, not unlike vegetable gluten, and is a compound of tannin and gelatine. It is this action of tannin on gelatine that is the foundation of the art of tanning leather. Gelatine when acted upon by sulphuric acid yields gelatine sugar on glycocoll. When treated with potash it is said to yield glycocoll and leucine. Gelatine is nearly related to the proteids. No chemical formula has yet been deduced for it. It is a nutritious article of food, and as part of the diet in hospitals produces the best effects; but animals fed exclusively on it die with the symptoms of starvation, as it cannot yield albumen, fibrine, or caseine. Its ultimate components are 47·8 carbon, 7·9 hydrogen, 16·9 nitrogen, 27·4 oxygen.

GELDERLAND, GUELDERLAND (gel'), a province of the Netherlands; area, 1,963 English sq. miles. Pop. 566,549.

GEMINI (jem'-inī), the Twins, the third sign of the zodiac, so named from its two brightest stars, Castor, of the first magnitude, farthest to the west, and Pollux, of the second, farthest to the east. Its constituent stars form a binary system revolving in about 250 years. The sun is in Gemini from about the 21st May till about the 21st June, or the longest day.

GEMMATION, in zool. a mode of reproduction among certain animals of low type, which consists in the production of a bud or buds, generally from the exterior, but sometimes from the interior, of the body of the animal, which buds are developed into independent beings that may or may not remain attached to the parent organism. This mode of reproduction is seen in the seamats, the fresh-water polyp, etc.

GEMS, or precious stones, are sometimes found crystalized in regular shapes and with a natural polish, more commonly of irregular shapes and with a rough coat. The term gem often denotes more particularly a stone that is cut, polished, or engraved, and it also includes pearls and various artificial productions. The first and most valuable class of gems includes diamonds, emeralds, rubies, sapphires, and a few others; the second class includes the amethyst, topaz, garnet, etc.; while agate, lapis-lazuli, cornelian, etc.; though much used for ornament, can scarcely be called gems. The various precious stones are described under their proper heads. The fabrication of artificial gems is now prosecuted with skill and capital, and has become an important industrial art. The base of one class of imitations is a peculiar kind of glass of considerable hardness, brilliancy and refractive power called paste or strass, which is distinguished from ordinary glass by the presence of 50 per cent of oxide of lead among its constituents. When the strass is obtained very pure it is melted and mixed with substances having a metallic base, generally oxides, which communicate to the mass the most varied colors. Another class, called semi-stones or doublets, are made by affixing thin slices of real gem to an under part of strass by means of an invisible cement. In some cases an imitation is made by setting uncolored strass or quartz in jewelry with some colored "foil" at the back of it. Attempts have within recent years been made with a fair measure of success to manufacture true gems by artificial processes. The French chemists Becquerel, Ebelman, Gaudin, Despretz, and others have done much in this direction. In 1858 MM. Deville and Caron communicated to the Academy of Sciences, Paris, a process for the production of a number of gems of the corundum class, as rubies, sapphires, etc. The process essentially consisted in exposing the fluoride of aluminium, together with a little charcoal and boracic acid, in a plumbago crucible protected from the action of the air, to a white heat for about an hour. Many experiments with a view to producing diamonds artificially have also been made. From hydrocarbons, subjected to a very intense heat and enormous pressure, minute fragments of crystalline carbon, differing from natural diamond in no respect save brilliancy, have been produced. In art and archæology the term gem is usually applied to a precious stone, cut or engraved in ornamental designs, or with inscriptions. Stones on which the design is raised above the general surface are called cameos; those having the design sunk below the surface are called intaglios. Early specimens of cut gems are seen in the scarabæi or beetle-shaped signets worn in rings by the ancient Egyptians. Among the Greeks, Etruscans, and Romans gem-sculpture held a high place, reaching its highest point under Augustus. Modern gem-engraving dates from the beginning of the 15th century, the chief seats of the art being Italy and Germany. Rome is now the headquarters of the seal-engraving art. The tools of the engraver consist of a lathe, and a series of little rods with heads of different shapes, all of which can be adjusted to the lathe. The axis of the lathe is pierced at the center with an orifice, into which the tools for cutting the stone are firmly fixed by means of a screw. The engraver wets the extremity of the mounted rod with diamond dust made into a paste with olive-oil, and as the wheel is in motion he applies the stone, firmly cemented to a piece of reed, to the revolving tool. The diamond dust enables the tool to cut into the stone with ease. As the design is frequently very elaborate and of the greatest delicacy, the tools are necessarily multiform. The stones used for cameo-cutting often exhibit layers of different colors, so that the raised design has a tint distinct from the ground. Intaglios are very often executed in transparent stones, and the subjects treated in this manner are more limited in number. They are chiefly such as seals, devices, coats of arms, etc.

GENDARMES (zhàn'dârm), the name originally given in France to the whole body of armed men, but after the introduction of standing armies to a body of heavy-armed cavalry, which composed the chief strength of the forces.

GENDER, in gram. one of those classes or categories into which words are divided according to the sex, natural or metaphorical, of the beings or things they denote. It may be exhibited by a class of words marked by similarity in termination, the termination having attached to it a distinction in sex, as seen in nouns, adjectives, participles, etc. There are three genders in all: masculine feminine, and neuter, but these distinctions only exist in some languages.

GENEAL'OGY, the systematical investigation and exhibition of the origin, descent, and relations of families (or their pedigree). Persons descended from a common father constitute a family. Under the idea of degree of relationship is denoted the nearness or remoteness of relationship in which one person stands with respect to another. A series of several persons, descended from a common progenitor, is called a line. A line is either direct or collateral. The collateral lines comprehend the several lines which unite in a common progenitor. For illustrating descent and relationship genealogical tables are constructed, the order of which depends on the end in view. The common form of genealogical tables places the common stock at the head, and shows the degree of each descendant by lines. Some tables, however, have been constructed in the form of a tree, in which the progenitor (German, Stammvater) is placed beneath, as if for a root.

GENERAL, a military rank and title denoting an officer holding a general command, or a rank and grade equivalent thereto. In modern armies, practically every officer commanding an organization of troops larger than a regiment is a general officer. In the U. States the rank has the following grades: brigadier-general, major-general and one lieutenant-general in supreme active command of the army as a whole. Officers of other ranks are sometimes given the temporary and relative rank of general, as inspector-general, judge advocate-general, quarter-master-general, etc. In European armies the rank of general is a step higher than that of lieutenant-general, and is the next in importance to field-marshal in England, and to marshal in the armies of Continental Europe.

GENERAL LIEN, in law, the right to retain possession of a chattel until payment be made, not only of any debt due in respect of that particular chattel, but of any balance that may be due on

general account in the same line of business. General liens do not exist at common law, but depend entirely upon contract, express or implied from the special usage of dealing between the parties.

GENERAL SERVICE AND STAFF COLLEGE, a military school for the further technical and professional education of military officers of the U. States Army, situated at Fort Leavenworth, Kan. The staff of the college detailed to assist the commandant, who is also the commanding officer of the post of Fort Leavenworth, consists of an assistant commandant, and the instructors in charge of departments. The instructors are detailed by the war department, and there are four departments—tactics, engineering, military law, military sanitation and hygiene. The course of instruction covers one year of two terms, the first term beginning on the 1st of September, unless that date fall on Saturday or Sunday, in which case the course begins on the following Monday. It ends on the 21st of December, concluding with the semi-annual examinations. The second term embraces the period from the 4th of January to the 30th of June following, concluding with the final examinations. The students are all graded in one class, which is divided into sections of convenient size and adaptation. The staff of the college note the names of students who have shown marked proficiency in any branch, with a view to the student's projessional employment in that particular branch.

GENERAL STAFF, an organization of superior or selected officers, appointed to the staff of a general officer commanding, whose duties may be generally described as converting the ideas of their chief into orders, not only by conveying them to the troops, but by working out all necessary matters of detail. The general staff organization was originally peculiar to Germany, but is now being generally adopted throughout Continental Europe.

GENERAL THEOLOGICAL SEMINARY, the leading seminary in the U. States of the Protestant Episcopal Church. The seminary was established by order of the general convention in 1817, and instruction was begun in New York City in 1819. The theological course proper extends over three years, and there is also a post-graduate course. The degrees of D.D. and B.D. are conferred; the former is both a higher academic and an honorary degree, while the latter is usually conferred in course on students holding prior academic degrees, who have completed the regular course in high standing. The control of the seminary is vested in a board of trustees composed of the bishops of the church, twenty-five members elected by the general convention, and certain other members elected by the various dioceses, principally that of New York. The student attendance is approximately 150. No tuition fee is charged, and many prizes of value are offered. Within twenty-five years the student body has largely increased, and extensive buildings have been elected, including the library, Hoffman Hall, the Chapel of the Good Shepherd, and nine dormitories.

GENERATION, a single succession of human beings (or animals) who are born, grow up, and reproduce their kind; hence, an age or period of time between one succession and the next, as the third, the fourth, or the tenth generation. The length of a generation is usually estimated at about thirty years.

GENERATION, SPONTANEOUS, or **ABIO-GENESIS,** the doctrine that living matter may originate spontaneously, "that under certain circumstances dead matter may build itself up into living matter without the intervention of already existing protoplasm." In the 17th century this was the dominant view, sanctioned alike by antiquity and authority, and was first assailed by Redi, an Italian philosopher. Buffon held the doctrine in a very modified degree. He held that life is the indefeasible property of certain indestructible molecules of matter which exist in all living things, and have inherent activities by which they are distinguished from not-living matter, each individual living organism being formed by their temporary combination. Of course it is only animals or plants of very low type and minute size that have been supposed thus to be produced spontaneously from dead matter; and the readiness with which such appear, in circumstances in which one might suppose no germs of them could be present, gives some countenance to the belief. Thus even at the present day authorities are found who still declare their adherence to the doctrine of spontaneous generation, but there is every reason to believe that, whatever may have been the case with the first beginnings of life, living matter is now invariably derived from pre-existent living matter.

GENERIC NAME, in natural history, the denomination which comprehends all the species of a genus: thus, Canis is the generic name of animals of the dog kind.

GENESEE (jen-e-sē'), a river which rises in Pennsylvania, flows north through New York, and falls into Lake Ontario 6 miles below Rochester, after a course of 145 miles. It is notable for its varied and romantic scenery, and its extraordinary falls. These falls are five in number; three of them occur about 90 miles from the mouth of the river, and are respectively 60, 90, and 110 feet high. The other two are near Rochester, and are both about 100 feet high.

GENESIS, (Greek, creation, birth, origin), the first book of the Bible and of the Pentateuch, named in the Hebrew canon B'reshith (in the beginning), from the term with which it commences. From the Greek translators it received the name it is now commonly known by. Genesis consists of two great but closely-connected divisions:—(1) The history of the creation, the fall of man, the flood, the dispersion of the human race, chap. i.–xi. (2) The history of the fathers of the Jewish race, chap. xii.–l. A certain apparent difference of style and language, the occurrence of what seem gaps on the one hand, and repetitions and contradictions on the other, and the different use of the term for the divine name (Jehovah, Everlasting; and Elohim, Almighty), led very early to the question of the integrity of the book, and various critics have assumed larger or smaller interpolations.

GENEVA, a town in Switzerland, capital of the canton of the same name situated at the western extremity of the Lake of Geneva, where the Rhône issues, here crossed by several bridges, and dividing the town into two portions, the larger and more important of which is on the left or south bank. The more important public buildings are the cathedral or church of St. Pierre, a Gothic structure of the 10th, 11th, and 12th centuries, occupying the highest site in the town, and by its three towers forming the most conspicuous object within it, somewhat defaced externally by a very incongruous Greek peristyle; the town-house in the Florentine style; the Musée Rath, containing a collection of pictures and other works of art; the university building, nearly opposite the botanic garden, rebuilt in 1867–71, and containing the public library, founded by Bonivard, the prisoner of Chillon, in 1551, and now numbering 90,000 vols.; and the museum of natural history. The only important manufactures of Geneva are that of watches, musical-boxes, and jewelry. Geneva has ample railway communication, and is one of the principal entrances for tourists and travelers into Switzerland. Pop. 105,139.—The canton is bounded by the canton of Vaud and the Lake of Geneva, and by France. Area, 109 sq. miles. Manufactures consist chiefly of clocks and watches, musical boxes, mathematical instruments, gold, silver, and other metal wares, woolen cloths, and silk cloths of various descriptions, hats, leather, and articles in leather; and there are numerous cotton mills, calico-printing works, and dye-works. The territory of Geneva having, by the arrangements of the congress of Vienna, obtained an accession of fifteen communes, detached from France and Savoy, was admitted a member of the swiss confederation in 1814, and ranks as the twenty-second canton. Its constitution of 1848 is the most democratic in the federation. All religious denominations are declared to have perfect freedom, but two of them are paid by the state—the Roman Catholics, amounting to rather more than a third of the population, and the Protestant National Church. The language spoken is French. Pop. 131,674.

GENEVA, a city in Ontario co., N. Y., on Seneca Lake, the Seneca and Cayuga Canal and the Fall Brook, the Lehigh Valley, and the N. Y. C. and H. R. railroads. It is the seat of Hobart college the State agricultural experiment station. Pop. 11,543.

GENEVA, LAKE OF, or **LAKE LEMAN,** the largest of the Swiss lakes extending in the form of a crescent, with its horns pointing southward, between France on the south, and the cantons of Geneva, Vaud, and Valais: length measured on its north shore, 55 miles, and on its south shore 40 miles; central breadth, about 6 miles; area, 331 sq. miles; greatest depth, 900 feet. It is 1150 feet above the sea.

GENEVA BIBLE, a copy of the Bible in English, printed at Geneva; first in 1560. This version was in common use till the version made by order of James I was introduced.

GENEVA CONVENTION, an agreement concluded at an international conference held in Geneva in 1864, for the succor of the sick and wounded in time of actual warfare. The neutrality of hospitals, ambulances, and the persons attending on them was provided for; and the use of the red cross on a white ground as a sign of neutrality has received the adhesion of all civilized powers.

GENEVIEVE, the name of two female saints.—1. St. Geneviève, the patron saint of Paris; born at Nanterre, about 5 miles from Paris, in the year 423; died at Paris about the beginning of the 6th century. 2. St. Geneviève, by birth Duchess of Brabant, wife of Siegfried, count palatine in the reign of Charles Martel (about 570).

GENGHIS KHAN, or **JENGHIS KHAN** (jen'gis), Mongol conqueror, born about 1160, died 1227. His father was chief over thirty or forty clans, but paid tribute to the Tartar Khan. He succeeded his father when only fourteen years of age, and made himself master of the neighboring tribes. A great number of tribes now combined their forces against him. But he found a powerful protector in the great Khan of the Karaite Mongols, Oung, or Ung, who gave him his daughter in marriage. After much intestine warfare with various Tartar tribes Genghis was proclaimed Khan of the United Mongol and Tartar tribes. He now professed to have a divine call to conquer the world, and the idea so animated the spirit of his soldiers that they were easily led on to new wars. The country of the Uigurs, in the center of Tartary, had long excited his ambition. This nation was easily subdued, and Genghis Khan was now master of the greatest part of Tartary. Soon after several Tartar tribes put themselves under his dominion, and in 1209 he passed the great wall of China. The conquest of China occupied the Mongols more than six years. The capital, then called Yenking, now Peking, was taken by storm in 1215 and plundered. The murder of the ambassadors whom Genghis Khan had sent to the King of Kharism (now Khiva) occasioned the invasion of Turkestan in 1218 with an army of 700,000 men; and the two cities of Bokhara and Samarcand were stormed, pillaged, and burned. Seven years in succession was the conqueror busy in the work of destruction, pillage, and subjugation, and extended his ravages to the banks of the Dnieper. In 1225, though more than sixty years old, he marched in person at the head of his whole army against the King of Tangut (Southwestern China), who had given shelter to two of his enemies, and had refused to give them up. A great battle was fought, in which the King of Tangut was totally defeated with the loss of 300,000 men. The victor remained some time in his newly-subdued provinces, from which he also sent two of his sons to complete the conquest of Northern China. At his death his immense dominions were divided among his four sons.

GENIUS, a tutelary deity; the ruling and protecting power of men, places, or things; a good or evil spirit supposed to be attached to a person and influence his actions. The Genii of the Romans were the same as the Daimones (Demons) of the Greeks. According to the belief of the Romans, which was common to almost all nations, every person had his own Genius; that is, a spiritual being which introduced him into life, accompanied him during the course of it, and again conducted him out of the world at the close of his career. The Genii of women were called Junones. The Genii were wholly distinct from the Manes, Lares, and Penates, though they were allied in one important feature—the protection of mortals.

The term genii (with the singular genie) is also used as equivalent to the jinn (singular jinnee) of Arabic tales. These are supposed to be a class of intermediate beings. See Jinn.

GENLIS (zhän'lēs), Stéphanie Félicité Ducrest de St. Aubin, Countess de, French authoress, born near Autun 1746, died at Paris 1830.

GENOA (jen'o-a), a seaport of N. Italy, the chief commercial city of the kingdom, on the coast of the Mediterranean, at the head of the gulf of the same name, 75 miles s.e. of Turin. It

Strada Balbi, Genoa.

is beautifully situated at the foot and on the slope of the Ligurian Alps, the lower hills of which form a background to the city. In the newer quarters many of them are spacious, and are lined with palaces and other noble edifices. Some of the palaces are filled with works of art by the greatest masters. The principal are—the Ducal palace (now containing the law-courts and various public offices), the Palazzo del Municipio or town-hall, the Palazzo Brignole or Rosso (with the largest picture-gallery in Genoa), the Palazzo Pallavicini, the Palazzo Reale, built in the 16th century for the Durazzo family, was purchased in 1815 by the royal family, and the palaces of Doria, Serra, Cambasio, Balbi, and Duracco. The most remarkable of the churches is the Duomo, or Cathedral of St. Lorenzo, founded in the 11th century, but not completed till the beginning of the 12th; S. Maria in Carignano, built in imitation of the original plan of St. Peter's at Rome; S. Stefano, a Gothic church, the oldest parts of which date from the end of the 12th century; S. Ambrogio, containing two paintings by Rubens, and the Assumption of Guido Reni. The principal charitable institution is the Albergo de' Poveri, in which 1600 individuals, orphans and old people, find shelter. Others are the Ospedale del Pammatone founded in 1430; and a hospital recently built by the Galliera family. Among the theaters of the city may be mentioned the Teatro Carlo Felice, an elegant structure, with a splendidly fitted up interior. Besides the university, founded in 1775, the chief educational institutions are the theological seminary, the school of fine arts, the royal marine school, and the navigation school. It contains fine mortuary buildings and much statuary in white marble. The manufactures of Genoa include cotton and silk goods, gold, silver, paper and leather goods, sugar, and preserved fruits. The principal articles of export are cereals, oils, fruit, cheese, rags, the products of its manufactures, etc. Many emigrants embark here. Imports—cotton, wool, wheat, sugar, coffee, coal, hides, iron, etc.—Under the Romans Genoa was famous as a seaport. After the breaking up of the empire of Charlemagne, it constitued itself a republic, presided over by doges. From 1119 it was almost constantly at war with Pisa down to 1284, when Genoa inflicted a crushing defeat on Pisa. The Genoese obtained the supremacy over Corsica, and nominally over Sardinia, possessed settlements in the Levant, on the shores of the Black Sea, on the Spanish and Barbary coasts, and had a very flourishing commerce. The rivalry between Genoa and Venice was a fruitful source of wars during the 12th–14th centuries. Meanwhile the city was internally convulsed by civil discord and party spirit. The hostility of the democrats and aristocrats, and the different parties among the latter, occasioned continual disorder. From the contests of noble rivals, in which the names of Doria, Spinola, Grimaldi, and Fieschiare prominent, Genoa was drawn into the Guelph and Ghibelline contest. In the absence of internal tranquility the city sometimes submitted to a foreign yoke in order to get rid of anarchy. Pop. 234,800.

GENOA, Gulf of, a large indentation of the Mediterranean, in North Italy, at the head of which lies the city and port of Genoa. No precise points can be named as marking its entrance; but it may, perhaps, be generally said to comprise the entire space north of lat. 43° 40′ n.

GENRE (zhän'r') **PAINTING,** a term used in art to denote that class of subjects which portray the intimate and every-day life of any people This class of painting is characteristic of the Dutch school by which it was first largely practiced. Its chief masters in that school were Terburg, Brower, Ostade, Rembrandt, the younger Teniers, Metzu,

Gerard Dow, Frans Hals, and others. Their subjects were the familiar life of the family; street scenes and sports; festivals and picnics, tavern scenes—that goes to make up the occupations of a people. These might be comic, serious, or pathetic, but genre painting, strictly, speaking, always includes as a dominent note the human element. Pictures of this class are usually of small dimensions but they are always valuable and interesting records of contemporary life. In British art Wilkie and Hogarth are prominent examples of genre painters. Hogarth was probably the greatest master in English genre painting and his pictures portraying the weaknesses and follies of the life of his time are powerful parables, and full of artistic strength. Genre work was done in Spain by Velasquez and Murillo, and in France during the 18th century by Watteau, Greuze, and others. There was a general revival of this kind of subject during the 19th century, and among the many painters of all nations who have practiced it we need only mention such names as Meissonier in France, Fortuny in Spain, Kraus, Defregger, and Grützner in Germany.

GENSERIC (jen'), a king of the Vandals, who, having obtained joint possession of the throne of Spain with his brother Gonderic, crossed the Straits of Gibraltar with 50,000 men, A.D. 429, on the invitation of Bonifacius, the Roman governor of Africa, to assist him against the Moors. Two unsuccessful attempts were made by the eastern and western emperors to overthrow his power, but Genseric secured all his conquests, and, notwithstanding all his cruelties, was permitted to die in peace A.D. 477.

GENTIAN, a large genus of bitter herbaceous plants, having opposite, often strongly ribbed, leaves, and blue,

Yellow gentian.

yellow, or red, often showy flowers. The root has a yellowish brown color and a very bitter taste, and is exported in considerable quantities, and is used medicinally, and also as an ingredient of cattle foods.

GENTILE, in Scripture, anyone belonging to the non-Jewish nations and not a Christian; a heathen. The Hebrews included in the term goim, or nations, all the tribes of men who had not received the true faith, and were not circumcised. The Christians translated goim by the L. gentes, nations, and imitated the Jews in giving the name gentiles to all nations who were not Jews or Christians. In civil affairs the denomination was given to all nations who were not Romans.

GENUFLEXION, the act of bending the knees in worship. There are frequent allusions to genuflexion in the Old and New Testaments, and it would appear that the use was continued among the early Christians. Genuflexion obtains, both by rule and prescription, in various places in the offices of the Roman Catholic Church, and at different parts of the services of the Church of England.

GENUS, in scientific classification, an assemblage of species possessing certain characters in common, by which they are distinguished from all others. It is subordinate to order, tribe, and family. A single species, possessing certain pecular characters which belong to no other species, may also constitute a genus, as the giraffe.

GEODESY (jē-od'e-si), the science of surveying extended to large tracts of country; the branch of applied mathematics which determines the general figure and dimensions of the earth, the variations of the intensity of gravity in different regions, etc., by means of direct observation and measurement.

GEOFFROY ST. HILAIRE (zhof-rwȧ saṇ tē-lār), Etienne, French naturalist, born in 1772, died in 1844. As a member of the Egyptian expedition in 1798 he founded the Institute of Cairo, and returned about the end of 1801 with a rich collection of zoological specimens. In 1807 he was made a member of the Institute, and in 1809 professor of zoology at the Faculty of Sciences. He devoted himself especially to the philosophy of natural history. The fundamental idea brought conspicuously forward in all his works is, that in the organization of animals there is only one general plan, one original type, which is modified in particular points so as to present differences of genera. This view met with strong opposition from Cuvier. Among his principal works are Sur le Principe de l'Unité de Composition Organique; Philosophie Anatomique; Historie Naturelle des Mammifères, written in conjunction with Cuvier; Notions de Philosophie Naturelle (1838).

GEOFFROY ST. HILAIRE, Isidore, physiologist and naturalist, son of the preceding, was born at Paris 1805, died 1861. He devoted himself to natural history, and in 1824 was appointed assistant to his father at the Jardin des Plantes. He was the means of founding the Acclimatization Society of Paris.

GEOGRAPHICAL SOCIETIES, are associations formed with the view of obtaining and disseminating geographical knowledge. In point of seniority the first of these associations is the Société de Géographie of Paris, founded in 1821. The Prussian Gesellschaft für Erdkunde held its first sittings in Berlin in 1828. The Royal Geographical Society, established in London in 1830, The Royal Scottish Geographical Society, founded in 1884. The Russian Geographical Society, founded at St. Petersburg in 1845, has greatly extended our knowledge of Asia, and especially Asiatic Russia. The American Geographical Society was founded at New York in 1852, and the National Geographical Society at Washington in 1888. Italy has her Società Geografica, founded at Florence in 1867.

GEOGRAPHY, the science which treats of the world and its inhabitants giving an account of the earth as a whole and of the divisions of its surface, natural and artificial, describing the different countries, states, provinces, islands, cities, etc. It may be regarded as embracing several departments or branches. Mathematical Geography is that branch of the general science which is derived from the application of mathematical truths to the figure of the earth, and which determines the relative positions of places, their longitudes and latitudes, the different lines and circles imagined to be drawn upon the earth's surface, their measurement, distance, etc. Physical Geography treats of the physical condition of the earth, its great natural divisions of land and water, the atmosphere, and the movements of oceanic and aërial currents; the geological structure of the earth; and the natural products of the earth, vegetable and animal. It is concerned chiefly with general laws and principles, as they are manifested upon a grand scale, and in the organic kingdom with the existence of groups of animals and plants. This branch approaches at various points the sciences of geology, hydrology, meteorology, botany, zoology, and ethnology. Political Geography embraces the description of the political or arbitrary divisions and limits of empires, kingdoms, and states; and treats of their government, laws, social organization, etc.

The earliest idea of the earth formed by mankind seems to have been that it was an immense disc, in the center of which their own land was situated, surrounded by the ocean, and covered by the sky as with a canopy. The Phœnicians were the first people who made any great progress in extending the bounds of geographical knowledge. They seem to have explored all the shores of the Mediterranean, and at an early period to have passed the Pillars of Hercules (the Straits of Gibraltar), and visited to some extent the Atlantic shores of Europe and Africa, extending their voyages as far north as Britain, and as far south as the Tropic of Capricorn. In the Homeric poems (which may be regarded as representative of the ideas entertained by the Greeks about the commencement of the 9th century B.C.) the earth is supposed to resemble a circular shield surrounded by a belt of water which was the source of all other streams. The world of Herodotus (born 484 B.C.) extended from the Atlantic to the western boundary of Persia, and from the Red Sea or Indian Ocean to the amber lands of the Baltic. The Indian expedition of Alexander the Great (330 B.C.) greatly enlarged the ancient knowledge of Northern and Eastern Asia. About 320 B.C. Pytheas, a seaman of Massilia (ancient Marscilles), a Greek colony, sailed along the western coasts of Spain and Gaul, visited Britain, and, pursuing his voyage, discovered an island, henceforward famous as Ultima Thule, which is supposed to have been Iceland. Eratosthenes (276–196 B.C.) first used parallels of latitude and longitude, and constructed maps on mathematical principles. He considered the world to be a sphere revolving with its surrounding atmosphere on one and the same axis, and having one center The Geography of Strabo, a Greek of Pontus,

GEOLOGY

written about the beginning of the Christian era, embodies all that was known of the science at that period. The countries lying round the Mediterranean were known with tolerable accuracy, but the Atlantic shores of Europe were very vaguely comprehended, while of the northern and eastern portions the most erroneous notions prevailed. Pomponius Mela, an early Roman geographer, wrote about the time of the emperor Claudius. He divided the world into two hemispheres, the Northern or known and the Southern or unknown; the former comprising Europe n. of the Mediterranean and w. of the Tanis (Don); Africa s. of the Mediterranean and w. of the Nile; and Asia. The next famous geographer is Ptolemy, who lived at Alexandria about the middle of the 2d century A.D. In Europe, Spain and Gaul were now correctly delineated, together with the southern shores of Britain. Northern Germany and the southern shores of the Baltic were pretty well known, as also some portion of Russia in the neighborhood of that sea, and the southern part of European Russia. In Asia it was considered certain that there were wide regions inhabited by nomadic tribes called Scythians, while from the far east came some vague reports of China. The geography of Ptolemy remained the acknowledged authority during the whole of the middle ages. From his time up till the 13th century no advance was made in geographical knowledge until Marco Polo opened up new fields of inquiry. The account of his travels first made known to Europe the existence of Japan and of many of the East Indian islands and countries. Then followed the discovery of America in 1492, and from this time forward the progress of discovery was extremely rapid. In 1497 the Cape of Good Hope was doubled by Vasco da Gama, four years after its discovery by Bartholomew Diaz. Within thirty years from the date of the first voyage of Columbus the whole of the east coast of America from Greenland to Cape Horn had been explored. In 1520 Magellan passed the straits which bear his name, and his vessel, crossing the Pacific and Indian Oceans, returned to Europe by way of the Cape of Good Hope, being the first that had circumnavigated the globe. The west coast of America was explored as far as the Bay of San Francisco about the middle of the 16th century. At the same time discovery in the east advanced with rapid strides. Within twenty years of Gama's arrival in India the coasts of East Africa, Arabia, Persia, and Hindustan had been explored, and many of the islands of the great Archipelago discovered. The expeditions of Willoughby and Frobisher in 1553 and 1576, of Davis in 1585, of Hudson in 1607, and of Baffin in 1616, though they failed in their object of finding a n.w. passage to India, materially enlarged our knowledge of the Arctic regions. By the middle of the 17th century the Dutch, under Tasman and Van Dieman, made the Australian Islands known to the world. Late in the following century Captain Cook added largely to geographical knowledge by his survey of the Pacific and its innumerable islands. The Antarctic continent was discovered in 1840 by American, English, and French expeditions, and the northwest passage round N. America was found by McClure in 1850. The travels of Humboldt, Spix and Martius, Lewis and Clark, Fremont, and others, have made us acquainted with the general features of the American continent. In Asia numerous travelers have contributed much to render our knowledge certain and precise in respect to a great part of the continent. The interior of Australia has been explored by Sturt, Eyre, Leichhardt, Burke, Wills, King, McDouall Stuart, etc. The opening up of the African interior has been materially advanced by the explorations of a host of travelers, including Bruce, Park, Denham, Clapperton, the Landers, Burton, Speke, Grant, Baker, Barth, Livingstone, Rohlfs, Schweinfurth, Cameron, Stanley, etc. The progress which has marked recent discovery has been materially assisted by the governments of various countries, and by the numerous geographical societies formed during the 19th century. The scientific study and teaching of geography are becoming more and more recognized to be of high importance, and in both at present Germany takes the lead. See also Geographical Societies, the articles on the different countries, and such articles as Earth Climate, etc.

GEOLOGY, is the science which treats of the history of the earth, as ascertained by the study of its exterior or crust, investigating the successive changes which have taken place in the rock-masses composing it, their relations, structure and origin, and discussing also the main features of the animal and vegetable life of the past as bearing on the earth's history. The present condition and conformation of the earth is the result of vast changes in the past and of agencies working through immense periods of time, and the same or similar agencies may still be seen at work producing similar changes. Thus rocks, both aqueous and igneous, are still being formed. The former receive their name from owing their origin mainly to water, which acts both chemically and mechanically on the crust of the earth, in wearing down rocks and soils and carrying the debris often to considerable distances. The sediments thus carried to sea, or into lakes and estuaries, are spread abroad in the water, and form stratified deposits, which in course of time solidify into rock. With sufficient time all land would thus be eventually degraded beneath the sea, were it not that the loss is compensated by disturbance and elevation of land always slowly taking place over great portions of the continents and islands of the world. Such disturbances have produced strange phenomena among the stratified rocks, which may be contorted, tilted up, dislocated, or otherwise changed from their original arrangement. The strata resulting from aqueous deposits are consolidated (petrified) chiefly by pressure and chemical decomposition and recomposition. Some formations are many thousands of feet in thickness. Contraction of the crust of the earth due to radiation of the heat of the earth into space, has also had immense effects, the result being that over broad areas rocky masses have been contorted and compressed to a great degree, and mountain ranges upheaved.

Igneous rocks also form a considerable portion of the visible crust of the earth, though much smaller in amount than those of sedimentary origin. Some of the igneous rocks consist of beds of volcanic ashes, others of old lavas, others of masses of matter which were intruded in a melted state from below among the strata. Granite is the most important and widely-spread of the igneous rocks, and is generally regarded as the fundamental rock of the earth's crust. Rocks that have been melted are known to be igneous by their structure, and also by the effects they have produced on the strata with which they are associated. Shales, sandstones, etc., are often hardened, bleached, and even vitrified at the points of junction with greenstone, basaltic, and felspathic dykes, or old lava beds, and the same kind of alteration takes place on a greater scale when large masses of igneous rocks have been intruded on the strata.

That the rocks which form the crust of the earth had the same general origin with the igneous rocks and sedimentary strata now forming has been well established, and that there is a regular succession of strata from the older to the newer the oldest being normally lowermost, the newest uppermost, is also well ascertained. A corresponding succession in regard to the animal and vegtable life of former ages has also been proved by the fossils that accompany the successive strata. This superposition of strata and the succession of life in time are two cardinal doctrines in geology. Observation and experiment alike established the doctrine of superposition. Thus at the edges of the strata on which London stands, the rocks known as the Woolwich and Reading beds are seen to lie on the chalk. Far within these edges, well-sinkers are well aware that often after sinking several hundred feet through the London clay the chalk is reached. In like manner proceeding westward across the middle of England, it is found that the Chalk rests on the Green-sands, the Green-sands on the Upper Oolites, the Lower Oolites on the Lias, the Lias on the New Red marl, and so on through lower members of the geological series of English rocks. Each great group of rocks consists of several subdivisions called formations, and each group. and even to a considerable extent each minor subdivision, is characterized by the presence of distinct assemblages of organic remains. The successive appearance of such remains, which constitutes the succession of life in time, was the great discovery of Wm. Smith, made nearly a century ago.

Igneous rocks also are associated in different localities with the systems named in the following table.

In the small area of Great Britain a more complete series of rocks exists than in any other part of the earth's surface of equal dimensions—so far as is known. The greater part of the European series is, indeed, nearly complete in England and Wales alone; and since the days of William Smith, the British rocks have

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generally been the types to which formations in other parts of the world have been referred.

The main rock-systems into which the earth's crust is divided, and which are based on the characteristics of the organic remains contained in them, are shown in the following table in ascending order:

Life Periods.	Rock Systems.	
Post-Tertiary or Quaternary	Recent—Alluvium, Peat, etc.	
	Pleistocene.	
Tertiary or Kainozoic	Pliocene.	
	Miocene.	
	Oligocene.	
	Eocene.	
Secondary or Mesozoic	Cretaceous.	
	Jurassic.	Oolitic.
		Liassic.
	Triassic.	
Primary or Palæozoic	Permian.	
	Carboniferous.	
	Devonian and Old Red Sandstone.	
	Silurian.	
	Cambrian.	
Archæan, Laurentian, or Eozoic	Fundamental Gneiss.	

Archæan, Pre-Cambrian, or Laurentian Rocks.—The Laurentian are the oldest known of the sedimentary rocks. They are metamorphic (that is, changed from their original structure), and mostly gneissic in character, and were for long classed as granitic and igneous rocks till their true nature was shown by Sir William Logan. They occupy vast tracts of country in Labrador and Canada. They there consist of two divisions, Lower and Upper Laurentian. The gneiss of the lower division is interstratified with several thick bands of crystalline limestone, in one of which a remarkable structure believed by Dawson, Carpenter, and others to be a foraminifer and called Eozoon Canadense was found. This is the oldest known fossil, if indeed it be a true fossil. In the Outer Hebrides and on the west coast of the North Highlands, rocks occur of highly metamorphic gneiss, which are probably of Laurentian age. The term Pre-Cambrian or Archæan is now applied to these rocks in the British area; they crop out also in North and South Wales, in the Malvern Hills, and in Charnwood Forest in Leicestershire. No fossils have yet been observed in these rocks. The Huronian Rocks of N. America are possibly intermediate in age between the Laurentian and the rocks next mentioned.

Cambrian.—These rocks come next in succession to the Laurentian strata. The term Cambrian has been used differently by geologists. In most places they are unfossiliferous (or only doubtfully so), but at St. David's, in North Pembrokeshire, numerous fossils in purple shales among the lowest beds of the series have been found, including a small bivalve crustacean and two brachiopods. In a higher part of the series two sponges and varied trilobites have been found. In Sutherlandshire, red Cambrian conglomerates lie on the Laurentain strata uncomformably. Cambrian strata also occur in the hills of the Longmynd of Shropshire, in South Staffordshire, etc.

The Silurian Rocks were first worked out in detail in South Wales and the bordering counties by Sir Roderick Murchison, and an account of them published in the year 1839 in his Silurian System. The Silurian is divided into the Lower and Upper Silurian. The former comprises in ascending order the Lingula beds (so named from a characteristic fossil shell), the Tremadoc slate, the Llandeilo flags, and the Caradoc or Bala beds. The Lingula flags (Potsdam sandstone of North America) rest conformably on, and in fact pass by gradations into the Cambrian rocks. They are best developed in Wales, in Merionethshire, Carnarvonshire, and at St. David's, and consist of black and gray slaty rocks with beds of grit. The mass of hills that extends across the south of Scotland, from Wigtonshire on the southwest to St. Abb's Head on the eastern coast, is mostly formed of Lower Silurinan strata. They chiefly consist of gray grits and gray and black shales here and there containing fossils. Further south, in Cumberland, Westmoreland, and North Lancashire, Lower Silurian strata form the chief mass of the mountains known as the Cumbrian region. The Skiddaw region consists of black slates. Above these there lies a great series of volcanic rocks, consisting of felspathic lavas and ashes, commonly known as the green slates and porphyries. The Llandeilo flags in North Wales are named from the town of Llandeilo in Carmarthenshire, where they occur in a typical form. Above and passing into these lie the Caradoc or Bala beds. (Trenton limestone of N. America). The most characteristic fossils of the Lower Silurian are the crustaceans known as trilobites, of which more than 200 species are known to belong to these rocks. Other fossils include hydrozoa, corals, echinodermata, numerous mollusca (brachiopods in particular, also lamellibranchiates, pteropods, gasteropods, cephalopods or cuttle-fishes). No fishes nor any other vertebrate animals have yet been found in the Lower Silurian rocks. The Lower Silurian rocks in the British and in some other areas were upheaved, contorted, and denuded before the deposition of the Upper Silurian strata, which, therefore, lie generally unconformably upon them. The chief groups forming the Upper Silurian are, in ascending order, the Pentamerus beds (so called from the brachiopod Pentamerus oblongus), the Tarannon shale, Woolhope limestone, Wenlock shale, Wenlock limestone, and Ludlow rocks, in the middle of which is the Aymestry limestone. In North America the Oriskany and Niagara beds are of this age. The Upper Silurian limestones are absent in Scotland and over the greater part of Wales. All of these formations are in general terms fossiliferous. The Wenlock limestone is in great part formed of corals, encrinites, shells, and trilobites, corals predominating. Near the top of the Upper Ludlow strata there are several thin bone-beds containing small teeth and scales and defenses of placoid fish: with the exception of a fragment of a fish found in the Lower Ludlow beds in Shropshire, these are the oldest known fishes. Many geologists now classify the Silurian system very differently from the above method. They assign the Tremadoc and Lingula beds to the Cambrian formation; and the Llandeilo and Caradoc beds are put into a distinct formation called the Ordovician.

Old Red Sandstone and Devonian.—Old Red Sandstone first received that name in contradistinction to the New Red Sandstone, the former occurring below, and the latter above the Carboniferous strata. Where the uppermost Silurian strata join the Old Red Sandstone there is a gradual passage between them. A broad belt of Old Red Sandstone crosses Scotland in a northeast direction between the Firth of Clyde and Montrose and Stonehaven. This broad tract lies uncomformably on Lower Silurian clay-slates, and dips to the southeast under the Carboniferous or coal-bearing rocks that occupy the great central depression through which the Forth and Clyde chiefly run. On the southeast side of this broad undulating hollow the Old Red Sandstone again rises from beneath the Coal-measures with a general northwest dip, and skirting the Lammermuir Hills, strikes southwest into the sea south of Ayr. On the south side of the Lammermuirs it again appears on the hills between Berwick and Hawick, dipping under the Carboniferous rocks that, without a break, stretch from Berwick to the neighborhood of Derby. The first compendious account of the Old Red Sandstone of Scotland was given by Hugh Miller, those rocks and the remarkable forms of fish (Pterichthys, Cephalaspis, etc.) they contain being till his time almost unknown. In North Wales and Cumberland narrow streaks of red sandstone here and there show themselves between the Silurian rocks and Carboniferous limestone. South of Coalbrookdale it ranges, in great force, through parts of Shropshire, Herefordshire, and Gloucestershire, into South Wales, where it stretches westward to the west coast of Pembrokeshire, the whole being about 8000 feet in thickness. These English and Welsh rocks are united by their fossils to the Old Red Sandstone of Scotland. The absence of marine shells and the nature of the fossil fishes of the Old Red Sandstone indicate that the formation was deposited, not in the sea, but in a great fresh-water lake, or in a series of lakes, for the nearest living analogues of many of the fish are the Polypterus of the African rivers, the Ceratodus of Australia, and in less degree the Lepidosteus of North America. In Canada, the sandstones of Gaspé are of Devonian age, as is found by their containing Cephalaspis.

The name Devonian has been given to a series of rocks in Devonshire bearing fossils intermediate in character between those of the Upper Silurian and those of the Carboniferous limestone, and which are considered as the equivalents of the Old Red Sandstone of the west of England and of Scotland. The terms Devonian and Old Red Sandstone are thus generally considered equivalent in point of time. These rocks have been divided into Lower, Middle, and Upper Devonian. The lower beds chiefly consist of slaty beds, and green and purple sandstones, with brachiopods. The middle group, which includes the Plymouth limestone, contains numerous corals. The Upper Devonian group contains

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land plants (Stigmaria, etc., and many shells), some of which are identical with those found in the Lower Carboniferous limestone-shades.

Carboniferous Rocks.—In the south and middle of England, and in Ireland, the Carboniferous Rocks so named on account of the masses of coal contained in them, consist chiefly of limestone at the base and Coal-measures above. Including the South Wales, the Forest of Dean, and the Somersetshire areas, a typical section of the beds is as follows:

	Feet.		Feet.
Coal-Measures	1,000	to	12,000
Millstone grit	500	"	1,000
Yoredâle rocks	100	"	1,000
Carboniferous or Mountain limestone	500	"	2,500
Carboniferous limestone shale	100	"	500
Yellow Sandstone, with plants	100	"	200

Generally resting on Old Red Sandstone.

The Yellow Sandstone beds form a kind of passage from the Old Red Sandstone to the Carboniferous rocks, and the plants have carboniferous affinities. The overlying shales in Pembrokeshire, etc., contain numerous fish-teeth, Spirifers Productas, and a few Lingulas (all brachiopods); and the limestone, which is more than 2000 feet thick in South Wales, near Bristol, and in Somersetshire, is also so highly fossiliferous that it may be stated that the whole of this limestone has once formed parts of animals. The Yoredale rocks of Yorkshire consist chiefly of shales and sandstones, with marine shells and occasional land-plants. The Millstone grit of South Wales is comparatively unfossiliferous, but sometimes contains the remains of plants, and more rarely marine shells. The Coal-measures and Millstone grit of Monmouthshire, Glamorganshire, and Pembrokeshire, lie in a great oval basin, encircled by a rim of limestone, beneath which lies the Old Red Sandstone. The Coal-measure beds consist of alternations of sandstone, shale, fire-clay or under-clay coal, and ironstone. Underneath each bed of coal is a bed of underclay with the roots known as Stigmariæ, forming the soil in which the plants were rooted, by the decay of which, passing into peat, material was supplied for the production of coal. The Gloucestershire and Somersetshire coal-field was originally joined to the South Wales Carboniferous rocks. The Coal-measures of the Bristol and Somersetshire coal-field are altogether about 7000 feet thick, and contain in all about forty-six beds of coal, with a total thickness of about 98 feet. The Coalbrookdale coal-field contains several bands of good nodular ironstone. There are in places twenty-two beds of coal, about ten of which are workable, some of them from 3 to 6 feet thick. The North Wales coal-field lies on a great thickness of Carboniferous limestone. The Denbighshire part contains at least seventeen beds of coal, most of which are worked, and the Flintshire part at least twelve beds. The basement beds of the South Staffordshire coal-field rest directly upon Upper Silurian rocks. This field, in the northern part, contains fourteen beds of coal. In the south several of these coalesce to form the thick coal, in places 40 feet in thickness, with two thin partings. The Warwickshire coal-field contains six beds of workable coal, besides ironstone. The Ashby-de-la-Zouch coal-field contains fifteen beds of coal. The Coalbrookdale, South Staffordshire, and Warwickshire coal-fields present so many points of resemblance, that undoubtedly they were all originally formed as one coal-field. North of this coal-field the Carboniferous rocks are somewhat modified in details. The Lancashire and Cheshire and North Staffordshire coal-fields, exclusive of the Mill stone grit, vary from about 3500 to 750 feet in thickness, including about forty-six coal beds in North Staffordshire, and fourteen in Lancashire. There are also many beds of ironstone. The Nottingham, Derbyshire, and Yorkshire coal-fields united give about fifteen beds of workable coal. All these are ironstone areas, and North Staffordshire is also the great pottery district of England. The Newcastle coal-field is about 1600 feet thick, and contains about sixteen beds of coal throughout the district. The lower coal-field of Northumberland is of the date of the Mountain limestone. A smaller coal-field overlies the Carboniferous limestone northeast of Whitehaven in Cumberland. The Whitehaven Coal-measures, which lie on the Carboniferous limestone, have fourteen beds of coal. The great Scottish coal-fields lie in a broad synclinal hollow, in which are the valleys of the Clyde and Forth. The whole tract is about 100 miles in length, by 40 to 50 in breadth. The Carboniferous strata of the Lothians cross the Firth of Forth beneath the sea, and form great part of Kinross and Fife. By far the larger part of the surface of Ireland, from the southern coast to Lough Neagh and Donegal Day, consists of the Carboniferous limestone series, lying sometimes on Old Red Sandstone, sometimes on Silurian rocks. There are a few small coal-fields, but these are merely the relics of one great coal-field that originally overspread the Carboniferous limestone of Ireland.

In the Carboniferous rocks more than 500 species of fossil plants have been named, a large proportion of which are ferns, including some tree-ferns. The remaining chief plants are gigantic club-mosses known as Calamites, Lepidodendron, and Sigillaria. Coniferous trees also occur, as do the wings and wing-cases of beetles and other insects, spiders etc., and some reptile forms. In the purely marine series of rocks, of which the Carboniferous limestone forms the most important part, we find corals, very numerous crinoids, brachiopods, also exceedingly numerous, and Lamellibranchiate molluscs. Many cuttle-fishes and numerous fish also occur; trilobites are scarce.

Coal-fields occur in France, Belgium, European Turkey, Hungary, Russia, India, China, Borneo, New Zealand, Australia, etc. The largest known coal-fields in the world are in the U. States. See Coal.

The Permian series succeeds the Carboniferous rocks, and were long considered as part of the New Red Sandstone. They were named Permian by Sir Roderick Murchison, from the government of Perm, in European Russia, where they largely occur. They consist of sandstone, red marl, etc., and contain a bed of the Magnesian limestone. Between the north of the Tyne and the neighborhood of Nottingham the Permian rocks skirt the Carboniferous rocks and lie on them unconformably. In Lancashire and Cheshire they chiefly consist of red marl and sandstone. The same rocks generally skirt the South Staffordshire coal-field, and the south part of the North Wales coal-field, and the east side of Coalbrookdale, is also bordered by Permian marls and sandstones. The fossils of the Permian group are generically and specifically few in number, but as a whole their affinities and grouping are decidedly Palæozoic. All the Permian fish have heterocercal tails, like the majority of the Palæozoic genera, in which the vertebral column is prolonged into the upper lobe of the tail, whereas in the modern fishes the vertebral column is not prolonged into either lobe. Excepting the Magnesia limestone, all the Permian rocks are red, and all, including this limestone, seem to have been deposited, not in the sea, but in an island salt lake, or in lakes.

The New Red Sandstone, or Trias, succeeds the Permian strata. It has received the name of Trias from the fact that when fully developed, as in Germany, it consists of three great divisions of Keuper, Muschelkalk, and Bunter Sandstein. Few old genera and no species pass thus far upward. The majority of the genera of Brachiopoda disappear, and the whole grouping of the fossils now ceases to be Palæozoic, and assumes a character common to the Secondary rocks. Triassic rocks extend from Devonshire along the Severn, round the eastern borders of the Palæozoic rocks of Herefordshire and North Wales. From thence they stretch eastward to the Permian and Carboniferous rocks of Lancashire, North Staffordshire, and Derbyshire. They surround all the midland coal-fields and Permian beds between Shrewsbury, Coventry, and Derby, and, everywhere unconformably overlying the Permian rocks, stretch north in a long band from Nottingham to the river Tees. In its greatest development in England, the Bunter series (of soft red standsone and quartz conglomerate) is about 3000 feet thick. The Muschelkalk (absent in Britain) may be well seen, among other places, near Gotha, and at Eisenach in Thuringia. It is a gray shelly limestone, rich in fossil mollusca. No fossils are known in the Bunter Sandstones of England, though a few are found in equivalent strata on the Continent. In England, above the upper soft red sandstone are beds of red, white, and brown Keuper sandstone, and red marl, often ripple-marked, and containing bones and footprints, chiefly of Labyrinthodont reptiles, together with a few plants, and a peculiar fish. The rock-salt of England lies in the Triassic red marls of the plains of Lancashire, Cheshire, and Worcestershire. This rock-salt was deposited in supersaturated salt lakes during the Keuper period; and this could only have been done by the evaporation due to solar heat acting on the waters of salt lakes which had no outflow, like the Great Salt Lake of Utah, for example, or the salt lakes of Central Asia. The Keuper red

marl (Upper Trias) varies from 500 to 2000 feet in thickness, and contains, besides other fossils, footprints and bones of reptiles. In the U. States the Triassic rocks of Virginia and N. Carolina contain workable beds of coal. The red sandstone of the Connecticut valley is of Bunter age. Above the Keuper strata occur a series of beds called the Rhætic beds, from similar strata in the Rhætic Alps. All over England, wherever the base of the Lower Lias is well seen, the Rhætic beds, rarely more than 50 or 100 feet thick, are found to lie between the Lias above and the New Red Marl of the Trias below. They must be considered as true beds of passage between the red marl and the next series of strata. At the base of the Rhætic beds have been found minute teeth of the earliest known mammal (Microlestes rhæticus), a small insect-eating marsupial.

The Lias and Oolite series succeed the New Red and Rhætic beds. On the Continent of Europe the Lias and Oolite together are termed Jurassic, because in a typical form they are largely developed in the range of the Jura. The Lias in England consists, in descending order, of the Upper Lias shale, or clay; Marlstone; Lower Lias shale, or clay and limestone. The Lower Lias is about 900 feet thick, and consists of beds of blue clay interstratified with beds of blue argillaceous limestone, which is largely quarried in Leicestershire, Warwickshire, etc., for hydraulic lime. The Lower Lias is well exposed in the coast section at Lyme-Regis. From thence the Lower Lias strikes north to the junction of the Severn and Avon, and again n.e. and n. to the sea-coast of Yorkshire, e. of the river Tees. The Lower Lias clay and lime, as a whole, is rich in the remains of life. These include crinoids, decapod crustaceans, Terebratulæ, and other Brachiopoda, and numerous Lamellibranchiate molluscs. Cephalopoda, such as ammonites and belemnites, are especially numerous, together with species of nautilus. Fish are numerous, and there appear in the Lower Lias a great number of remarkable reptiles, some of gigantic size, as the Ichthyosaurus, the Plesiosaurus, and the well-known Pterodactyle. The Marlstone series, or Middle Lias, which is generally a brown, ferruginuos, soft, sandy rock, is rich in many forms of ammonite and belemnite, etc. From the Upper Lias clay much alum shale, as also the well-known Whitby jet, is obtained. It is a stiff unfertile dark-blue clay. In Yorkshire, at the top of the Lower Lias and in the Marlstone, there are the well-known beds of ironstone so extensively worked at Middlesborough.

The Oolitic strata as a whole stretch across England from southwest to northeast, or from Portland Bill to North Yorkshire. The Inferior Oolite, the lowest member of the Lower Oolite, chiefly consists of beds of yellow limestone. Much of the limestone is oolitic that is to say, it is formed of small concretionary bodies, like the roe of a fish cemented together in a calcareous matrix. Above the Inferior Oolite limestone lies the Fuller's earth, so name because it contains in places beds of that substance. The formation consists of stiff blue clay, which varies in thickness from a few feet to 200 feet near Bath. The Great or Bath Oolite succeeds, and consists of Great Ooolite, covered by Forest Marble, and passing downward into Stonesfield Slate, which forms its base. The Stonesfield slate consists of beds of shelly laminated and oolitic limestone, with numerous fossils among them remains of mammals, viz.: the lower jawbones of four genera of small insectivorous marcupials. The Bath Oolite, of which the Forest Marble forms the upper part, is best developed near Bath, where it yields the celebrated stone of which that city is built. Among fossils of the Bath or Great Oolite are reptiles of the genera Teleosaurus and Megalosaurus, together with the gigantic Ceteosaurus (or whale-lizard), probably about 50 feet in length. During this part of the Oolitic epoch, while in the south of England the strata were exclusively marine, in the middle and north they were to a great extent estuarine, freshwater, and terrestrial.

The Middle Oolite consists of the Upper Calcareous Grit, Coral Rag, Lower Calcareous Grit, Oxford Clay, and the Kelloway Rock. The Oxford Clay is a dark blue clay, about 600 feet thick where best developed, running in a long band of varying width from the coast of Dorsetshire to the Derwent, in Yorkshire. The Kelloway Rock is an occasional thin band of calcareous sandstone near its base. The Coral Rag is a rubbly limestone, trending, with occasional interruptions, from Somersetshire to Yorkshire. It is associated in places with sandy strata known as the Calcareous Grits, and is often almost entirely composed of broken shells and sea-urchins.

The Upper Oolite consists of the Portland Limestone and Sand and Kimmeridge Clay. The Kimmeridge Clay is well exposed in Kimmeridge Bay, on the Dorsetshire coast, whence its name. Occasionally interrupted, it runs from thence north into Yorkshire. In places it is 500 or 600 feet thick, and consists of a stiff blue and sometimes black clay or shale. The Portland Limestone and Sand are best seen in the Isle of Portland. The celebrated Portland stone has been used in many public buildings, including St. Paul's. Like those of all the other Oolite formations it is cream-colored, and generally fossiliferous.

In Scotland the Lias, Inferior Oolite, Middle Oolite, and Oxford Clay occur in the Islands of Skye and Mull. On the east of Scotland, at and near Brora, in Sutherland, the Liassic and Oolitic strata have been long known. Oolitic rocks, known by the name of Juriassic, almost identical with those of Britain, occur largely in France; and the mountain range of the Jura, dividing France and Switzerland, is chiefly formed of Liassic and Oolitic rocks. From thence they range interruptedly northward and eastward, covering a large part of the plains of European Russia, and extending along the Himalayas.

As regards the fossil remains of the Lias and Oolite, a remarkable feature is the vast development of Cephalopoda, especially of the genera Belemnites, Nautilus, Ammonites, and Ancyloceras. There are also many genera and species of fishes, chiefly in the Lias, and the genera and species of reptiles are so numerous that this life-period has been sometimes called "the age of reptiles." The plants include ferns, horse-tails, conifers, cycads, etc. Viewed as a whole, the Liassic and Oolitic strata seem to have been deposited in warm seas round groups of islands formed of the older Palæozoic rocks of Europe, of which the Highlands of Scotland, Cumberland, and Wales formed parts, and from which rivers flowed, at the mouths of which the estuarine and fresh-water deposits of the north of England and Scotland were accumulated.

Purbeck and Wealden Strata.—These form a series of transition strata between the Oolite and the Cretaceous systems. They belong chiefly to the district of Kent and Sussex known as the Weald, and comprise the Weald clay, the Hastings sands and clays, and the Purbeck limestones, marls, and clays. The Purbeck beds, which succeed the Portland stone, are chiefly fresh-water strata, and the Hastings sand and Weald clay are almost exclusively fresh-water beds. Several remarkable reptiles occur in the Weald, including the Iguanodon, Plesiosaurus, and Pterodactyle, together with a number of Crocodiles.

The Cretaceous Formation is divided into a lower and an upper series of strata. The chief member of the former is the Lower Green-sand, forming a series of strata overlying the Wealden beds, and occurring in magnificent sections along the southern cliffs of the Isle of Wight, and elsewhere round the Wealden area. The general characters of the whole formation are white, yellow, ferruginous, and gray and green sands.

The Gault, which forms the base of the Upper Cretaceous series, is a stiff blue clay about 300 feet thick in its thickest development. It appears in the Isle of Wight, ranges round the escarpment of the Weald, and in the center of England, from the neighborhood of Devizes to the Wash in Norfolk. In general lithological characters, the Upper Green-sand in places somewhat resembles the Lower Green-sand. In part of the Wealden area it is difficult to separate from the Gault, there being a passage from one to the other. In Wiltshire the Upper Green-sand is about 200 feet thick.

The Chalk, from its familiar characters and uniformity of structure, is the most easily recognizable of all the British formations. From west to east it stretches from the neighborhood of Beaminster, in Dorsetshire, to Beachy Head and the North Foreland, and from thence north to Speeton, in Yorkshire. Its area in Europe and Asia is immense. It consists of a soft white limestone, and on examination with the microscope, much of it is found to consist of shells of Foraminifera, Diatomacea, spiculæ and other remains of sponges, Polyzoa, and shells, highly comminuted. Somewhat similar deposits are now forming in the open Atlantic at great depths, chiefly of Foraminifera of the genus Globigerina. In its thickest development in England the Chalk is about 1200 feet thick (in Dorsetshire, Hampshire, etc.). The Lower Chalk usually

contains no flints, and is somewhat marly at the base, while the Upper Chalk is interstratified with many beds of interrupted flints. As a whole, the Chalk dips gently from its western escarpment to the east and south, underlying the Tertiary strata of the Hampshire and London basins, and reappearing with precisely the same characters on the coast of France. Beyond England it stretches through France, northward into Sweden, and eastward into Asia. Plants are comparatively few in the Chalk, but animal remains are very numerous. More than eighty species of fish are known; various great reptile forms, as the Mosasaurus, Plesiosaurus, and Ichthyosaurus, Pterodactyles, etc. In England, and generally in Europe, there is a marked discordance between the fossils of the Chalk and those of the overlying Tiertary rocks; no fossils (except, perhaps, one Terebratula) being common to the two groups. In America the Cretaceous epoch presents some extraordinary reptilian forms of immense size, also various birds. The sands and marls of New Jersey, U. States, are of this age, and similar beds occupy extensive tracts in the western regions; but there is no true white chalk in America.

Of the Tertiary strata the Eocene Rocks form the lowest division. In England these lie in two basins, those of London and Hampshire, both surrounded and underlaid by the Chalk. The strata are divided into the Lower Eocene and the Upper Eocene or Oligocene. The Lower Eocene rocks lie sometimes on upper beds of Chalk, and sometimes on beds lower in the series. They are therefore highly unconformable, and in this we have the reason of the complete difference in the species of the Cretaceous and Eocene rocks, for great continental areas of Chalk were upheaved above the sea, and remained as dry land for a period of time so long that when they were again submerged the life of Cretaceous times had died out, and other forms appeared. To the Lower Eocene belong the Thanet Sand, the Woolwich and Reading beds, the London Clay, and the Bagshot Sands and Clays. The London Clay usually consists of brown and bluish-gray clay, and in the London basin varies in thickness from 50 to 480 feet. Its fossil remains include various palm-nuts and other fruits and leaves. Remains occur of birds allied to the vulture and kingfisher, and a small swimming-bird with tooth-like serratures on the bill; turtles and river tortoises are numerous. The Upper Eocene or Oligocene includes the Headon Hill Sands, the Osborne Beds, Bembridge Beds, and Hempstead Beds, groups of strata belonging to Hampshire and the Isle of Wight. In these beds various Ungulate mammalia are found, such as the Anoplotherium, Palæotherium, a kind of river-hog, tapirs, etc. In France, in the Paris basin, the Eocene strata are largely developed. The Wahsatch, Bridger and Uinta beds of N. America are of Eocene age.

The Miocene Rocks are not found in Britain, but are well represented by strata (mostly of fresh-water origin in Central France (Auvergne, etc.) and Switzerland. Over many parts of Europe, Asia, and America there are other Miocene strata, each more or less possessing peculiarities.

The Pliocene strata in Britain consist in descending order of the Cromer Forest Bed, Chillesford Clay, Mammaliferous or Norwich Crag, the Red Crag and the Coralline or White Crag of Suffolk. The Coralline or White Crag lies on the London clay in Suffolk, and consists of a patch of about 20 miles in length, and generally of less than 100 feet in thickness. It is rich in Polyzoa (formerly called Corallines, whence the name Coralline Crag). The general character of the climate seems to have been milder than at present. The Red Crag often lies in denuded hollows on the Coralline Crag, and is chiefly a ferruginous, shelly sand, very irregularly bedded. Many of its shells now live in British seas, and there are many reasons for believing that during the later part of the Eocene and through the Miocene epoch the area now called Britain was joined to the Continent. The Mammaliferous or Norwich Crag consists of sands, gravels, and shells, and contains remains of species of mastodon, elephant, hippopotamus, and horse, as also of the common otter, deer, etc. From the nature of the fossils it is believed to have accumulated near the mouth of a river.

The Post-tertiary or Quaternary Epoch is that immediately before the period in which we now are (the recent). It is characterized especially by various glacial phenomena, and in particular by numerous evidences of a glacial period, when the northern hemisphere was subjected to a climate of the utmost rigor. During this period what is now the British Islands was in great part covered by glacier ice, probably as thick as that of the north of Greenland at the present day. When the most extreme cold prevailed, the mountains of Scotland and Wales were literally smothered in ice. Much of the boulder clay which is found more or less all over the British Islands north of the Thames valley is simply the moraine matter of clay and boulders that in places lay below the ice, and was more or less urged forward by the advancing glacier mass. (See Glaciers.) It is believed that subsequently a slow submersion of the land took place, and that then icebergs deposited the stones, earth, etc., carried by them over part of what is now the low lands of England and other regions, and of neighboring seas; hence the presence of sands, gravels and clays, full of boulders and ice-scratched stones, intermingled with shells of arctic or semi-arctic type sometimes lying at heights of from 800 to 1200 and 1400 feet above the present sea-level. The same kind of phenomena are more or less universal over great part of Northern Europe and North America. On the elevation of the country after the cold had passed away Britain was reunited to the Continent and Ireland to Britain, by plains of boulder-drift across which many mammalia (including the mammoth), migrated into the country, some of them for the second time. Man also migrated into the British area along with such mammalia. Among Post-tertiary plants there are Scotch firs, pines, yews, oaks, alders. The mammalian remains include those of elephants, rhinoceroses, hippopotamus, the common horse, bison, aurochs, red deer, roe-deer, Irish elk, Machairodus (a tiger?), etc. Many of these animals remains are found in the celebrated bone caves, several notable examples of which have been investigated in Britain. (See Cave.) In these have been found not only such remains as those of the cave bear, cave hyena, fox, wolf, cat, lion, reindeer, Irish elk, bison, rhinoceros elephant, etc., but also the works of man, such as flint implements, and on the Continent of Europe his skull and other bones associated with the above-named mammalia.

GEOLOGICAL SOCIETY OF AMERICA, an organization for the promotion of the science of geology in North America, formed in 1888 as an outgrowth of the geological section of the American association for the advancement of science. The society is almost strictly professional with a membership of about 300. The organization issues the bulletin of the geological society of America.

GEOLOGICAL SURVEY, U. States, a bureau of the department of the interior, organized in 1879 as a consolidation of the independent surveys that had been active for several years in exploring the Western states and territories.

The functions of the geological survey, as originally outlined by law of congress, with subsequent modifications, include the preparation of a topographic map of the U. States; the investigation and mapping of the areal geology; the examination of mineral deposits; the collection of mineral statistics; the study of hydrography with reference to water-power and the irrigation of arid regions; and the classification of public lands. The preparation of the topographic map, a necessary preliminary to the geologic and hydrographic work, is carried on by the topographic branch of the survey. When completed the topographic map will give an accurate presentation of the surface features of the country. The geologic branch of the survey investigates the maps of the geological formations. The map, as rapidly as completed, is issued in folios; it shows the areal distribution of the various rocks, their geological structure, and the location of mineral resources. For the purpose of conducting special investigations of scientific or economic value, the geologic branch is organized in divisions, each of which covers a particular field.

GEOMETRICAL PROGRESSION, a series of numbers which increase or decrease by equal ratios: as, 2, 4, 8, 16, or 16, 8, 4, 2.

GEOMETRY, as its name implies, was primarily the mathematical science which has for its object the measurement of portions of the earth's surface; but now geometry may be termed the science which treats of the properties and relations of definite portions of space, such as surfaces, volumes, angles, lines. The relation between the parts of the same figure may be of two kinds,—of position or of magnitude; for example, two points in a straight line, four points on the

same circle, two straight lines perpendicular to one another, a straight line tangent to a circle, are relations of position. On the other hand, the proportionality of homologous lines of two similar figures, the equality of the square constructed on the hypotenuse of a right-angled triangle to the sum of the squares constructed on the sides containing the right angle, that of the volumes of two pyramids on equal bases and of the same height, are relations of dimension. But the relations of position govern the relations of dimension, and vice versa; that is, the one set of relations depend upon the other. Thus it is because a triangle is rectangular that the square constructed on one of its sides is equivalent to the sum of the squares constructed on the other two, and, vice versa, that relation between the magnitudes of the squares on the three sides depends on the triangle being right-angled. The geometer may draw indifferently from the study of a figure either the knowledge of the relations of position or that of the relations of dimension, on the condition that he knows how to apply relations of the one kind to those of the other; and the principal aim of geometry is to examine into the connection between the relations of magnitude and those of position.

Geometry may be conveniently divided into several principal sections—elementary geometry, practical geometry, analytical geometry, infinitesimal geometry, etc. Elementary geometry comprehends two parts—plane geometry, the object of which is the study of the simplest figures formed on a plane by straight lines and circles; and solid geometry or geometry of three dimensions, which treats of straight lines and planes considered in any relative position whatever, of figures terminated by planes, of the cylinder, of the cone, and of the sphere. Analytical geometry, either plane or solid, makes use of the method of co-ordinates introduced by Descartes and primarily applied to curves. In ancient times, though curves were studied and the principal properties of conic sections known, still no connection existed between these curves, nor was there any means of establishing one, so that the study of one was of no value to that of another. The first question in introducing the analytic method was then to fix upon some means which should serve to construct every curve by successive points as numerous and as closely brought together as is necessary in order to lay down the curve. Now the position of a point in a plane may be determined by two intersecting perpendiculars drawn from two fixed lines—the co-ordinates axes—at right angles to each other. An equation may then be found which states the relation between the co-ordinates of any point, that is, its distance from the two co-oridnate axes. (See Co-ordinates.) The study of the curves will thus be simply the study of their equations. In this way a typical equation for a curve in a certain system may be got, so that if at another time the curve is represented under another definition in investigating its equation in the same system of co-ordinates, particularized so as to simplify as much as possible the calculations, it will suffice to compare the particular equation with the general one to verify the identity of the curve, to give it its name, and to know all the properties of it which have been studied previously. In a similar way the analytical geometry of solid bodies is based on the fact that the position of any point in space can be determined by reference to three intersecting planes. Infinitesimal geometry is simply a continuation of the analytical geometry of Descartes, of which it may indeed be said it forms a part; the difference consists simply in the nature of the questions which, as they involve the measurement of magnitudes, the incessantly variable elements of which cannot be summed up by finite parts, require the use of the infinitesimal calculus. Descriptive geometry consists in the application of geometrical rules to the representation of the figures and the various relations of the forms of bodies according to certain conventional methods. In the descriptive geometry the situation of points in space is represented by their orthographical projections, on two planes at right angles to each other called the planes of projection.

GEORGE, Henry, American economist, born in 1839 in Philadelphia, Pa. In 1865 he began to write for the press and one of his earliest productions urges workingmen to think about political and social conditions, to find if it be possible to "check the tendency of society to resolve itself into classes that have too much or too little." At this time he was engaged as a reporter on the San Francisco Times, where he was quickly promoted to the position of chief of staff. The great fortunes acquired in California through the rapid increase in the value of land fixed his attention upon the land problem; and in a pamphlet published in 1871, entitled Our Land Policy, he advanced most of the ideas that later appear in Progress and Poverty, his most important work—that the value of land represents in the main a monopoly power, and that the entire burden of taxation should be levied upon it, thus freeing industry from taxation, and equalizing opportunities by destroying monopoly advantages.

In 1886 George became a candidate for the mayorality of New York City, but was defeated by Abram S. Hewitt. In 1896 he again ran for mayor, but died before election day.

GEORGE, St., a saint venerated both in the eastern and western churches, and the patron saint of England. He was canonized in 494 or 496 by Pope Gelasius. His origin is very obscure, one of many legends representing him as a prince of Cappadocia, martyred by Diocletian. Gibbon has sought to identify this legendary saint with the notorious and turbulent Arian heretic George of Cappadocia, who was slain in 361 in a rising of the populace who had been infuriated by his oppression and his violence against pagans and orthodox. But the most eminent scholars, both Roman Catholic and Protestant, are of opinion that the veneration of St. George has been traced up to so early a period as to make it very improbable that a notorious Arian could have been foisted on the Catholic Church as a saint and martyr. The killing of a dragon that was about to swallow a maiden is a legendary feat attributed to him. He was adopted by the Genoese as their patron saint, and in 1222 the Council of Oxford ordered that his day (the 23d of April) should be observed as a national holiday in England; in 1350 he was made the patron of the order of the garter by Edward III.

GEORGE I., King of Great Britain, and Elector of Hanover, was the son of the Elector Ernest Augustus, by Sophia, daughter of Frederick, elector palatine, and grand-daughter to James I. He was born May 28, 1660, and in 1682 was married to Sophia Dorothea of Zell, whom, in 1694, on account of a suspected intrigue with Count Königsmark, he caused to be imprisoned and kept in confinement for the rest of her life. In 1698 he succeeded his father as elector. He commanded the imperial army in 1707 during the war of the Spanish succession; and ascended the throne of Great Britain on the death of Queen Anne in 1714. Among the notable events of his reign were the rising of the Scottish Jacobites (1715–16); the Triple and Quadruple Alliances against Spain (1717 and 1718); the failure of the South Sea Company (1720). The private character of George I. was bad, but he showed much good sense and prudence in government, especially of his German dominions. By Sophia Dorothea he had a son, George, afterwards George II. of England, and a daughter, Sophia, the mother of Frederick the Great. He died in 1727.

GEORGE I., "King of the Hellenes," was born at Copenhagen Dec. 24, 1845, second son of the King of Denmark. In 1863 he was elected king by the Greek national assembly. In 1867 he married the Princess Olga, a niece of the Russian czar.

GEORGE II., King of Great Britain, son of George I., was born Oct. 30, 1683. He married in 1705 Wilhelmina Carolina of Brandenburg-Anspach. In 1708, then only electoral prince of Hanover, he distinguished himself at Oudenarde under Marlborough. In 1727 he succeeded his father on the English throne, but inherited to the full the predilection of George I. for Hanover. His reign is notable for the great events with which it is filled, and for the number of men great in art, letters, war, and diplomacy which then adorned England. The war of the Austrian succession, in which George II. himself took part at Dettingen, the Jacobite rebellion of 1745, the conquest of Canada, and the growth of the British empire in India are among the chief events of his reign. George II. died suddenly Oct. 25, 1760. He was a prince of very moderate abilities, regardless of science or literature; of obstinate temper and vicious habits; but honest and open in his disposition.

GEORGE III., King of Great Britain, born in 1738, was the eldest son of Frederick, prince of Wales, by the Princess Augusta of Saxe-Gotha, and succeeded his grandfather, George II., in 1760. In the following year he mar-

ried the Princess Charlotte Sophia of Mecklenburg-Strelitz. The sixty years of his reign are filled with great events, among which are the Wilkes' controversy, the American revolution, 1775–83; the French revolution, 1789, and the

King George III.

Napoleonic wars which followed; the Irish rebellion, 1798, etc. His private life was very exemplary. In 1810 the king's mind, which had already given way several times, finally broke down, and from that time to his death on Jan. 29, 1820, his biography is a blank.

GEORGE IV., King of England, son of George III. and the Princess Charlotte of Mecklenburg-Strelitz, born in 1762, died June 26, 1830. In 1811 George became regent, and, on the death of George III. in 1820, king. The most important event after his attaining the throne was the passing of the Catholic emancipation act, by the Wellington ministry, in 1829. George IV. left no descendants, his only daughter, the Princess Charlotte, wife of Leopold of Saxe-Coburg, having died childless in 1817. He was therefore succeeded by his brother, William, duke of Clarence (William IV.) See Britain.

GEORGETOWN, a suburb of Washington, D. C., contains the Georgetown college (the oldest Catholic college in the U. States), the Peabody library, etc. The Chesapeake and Ohio canal commences here.

GEORGETOWN, or **DEMERARA,** the capital of British Guiana, at the mouth of the Demerara. The chief exports are sugar, rum, and coffee. Pop. 53,176, about one-seventh being whites.

GEORGIA, was formerly a kingdom, but is now included in the Russian government of Tiflis, though the name is sometimes loosely employed to designate a much larger portion of the territory possessed by Russia south of the Caucasus. In the latter sense it has an area of say 34,000 sq. miles, but Georgia proper does not exceed about 15,000 sq. miles. The natives are a fine-looking race, the Georgian women, like the Circassians, being celebrated for their beauty. The Georgian language, together with that of the Mingrelains, Lazes, and other Caucasian peoples, seems, according to the latest researches to form a perfectly distinct linguistic family. It possesses a not unimportant literature, commencing with the introduction of Christianity, into the country. The history of the Georgians first becomes trustworthy about the time of Alexander the Great, to whom they became subject. About B.C. 324 they gained their independence under Pharnavas. They became Christianized toward the end of the 4th century. After yielding for a time to the supremacy of the Arabian caliphs Georgia regained its independence toward the end of the 10th century, which it retained till 1799, when Heraclius, successor of George XI., formally ceded his dominions to the Russian emperor Pau.

GEORGIA, one of the southern U. States, bounded n. by Tennessee and North Carolina, e. by South Carolina and the Atlantic, s. by Florida, and w. by Alabama; length, north to south, 320 miles; breadth, 255 miles; area, about 58,000 sq. miles (same as England and Wales). The coast is bordered by a chain of islands, separated from the mainland by narrow lagoons or sounds. On them the famous sea-island cotton is raised. The land is low toward the coast, beginning as a salt marsh, grown over with tall reeds, continuing next as swampy rice plantations and then as "pine barrens" about 60 or 90 miles inland, latterly gradually rising as a sandy district, interspersed with fertile tracts, till it reaches the lower falls of the Savannah, Ogechee, Oconee, and other rivers. Here the hilly and finally mountainous region called the Upper Country begins, a fertile and salubrious region extending north and west till it rises into the Appalachian mountain chain. Of the rivers the Chattahoochee, which flows under the name of the Appalachicola into the Gulf of Mexico, is navigable for steamers for 300 miles; the Savannah is navigable for steamers part of the year for 250 miles; and the

Seal of Georgia.

Altamaha and its affluents are navigable for small vessels 300 miles upwards. The climate is mild, but unhealthy in the low country during July, August, and September. The soil in many parts is very rich. Cotton, rice, maize, and the sugar-cane are the staple productions; but tobacco, the sweet potato, and other crops are cultivated with success. The fruits, which include peaches, apples, melons, oranges, bananas, etc., are of the finest. Copper and iron, also gold in considerable quantities, are found in the northern parts. Atlanta is the seat of the legislature and the largest town; the other principal towns are Savannah (the chief seaport), Augusta, Macon, and Columbus. A charter for the foundation of a colony in the territory now called Georgia was obtained in 1732 by General Oglethorpe from George II., after whom the state was named. Georgia was one of the thirteen original states.

The first English settlement in the state was made in 1733, by a band of immigrants under the direction of Gen. James Oglethorpe, who first landed at Savannah. The relations between the Indians (of whom there were two powerful tribes—the Cherokees and the Creeks) and the settlers at first were amicable, and were never disturbed until the French and Indian war, during which the Cherokees plundered and burned some of the remote frontier hamlets and killed a few of the settlers. The extent of the territory comprised in the original colony was much greater than the area of the present state, and by treaty with France and Spain at one time it extended to the Mississippi River on the west and included a goodly portion of Florida on the south. When the revolutionary war began, Georgia was in a flourishing condition, having a population, including negroes (slavery having been introduced in 1750), estimated at over 75,000. The state was destined to become the scene of important military operations during the progress of the war, and several hard-fought battles between the British on the one side, and the French and Americans on the other, took place, those of greatest magnitude being at Augusta and Savannah. Although defeated and compelled to abandon Augusta at first, the British recaptured the town, and held Savannah and the entire state in subjection (with the exception of minor guerrilla warfare) until General Greene succeeded in forcing them to retire, in 1782, after the surrender of Cornwallis, and before the signing of the treaty of peace between England and America. In 1803 two new territories were erected out of her domains, and these were afterward admitted to the Union as the States of Mississippi and Alabama, which loss of territory was, in a measure, compensated by possession of the large tract of country before that time occupied by the Creek Indians, who ceded it to the state in 1804. From 1815 to 1825 the troubles between the whites and Indians were of a nature so serious that the general government had to interfere and remove the Indians beyond the Mississippi.

When the civil war broke out, in 1861, Georgia passed the ordinance of secession, being the fifth state in order of priority to leave the Union. Atlanta fell before the victorious arms of Sherman, in September, 1864, and thence that general took up his "march to the sea," appearing before Savannah, December 10, 1864. After two weeks' hard fighting he succeeded in capturing the defenses and occupied the city. After the fall of the Confederacy Jefferson Davis fled to Georgia, and was captured near Macon by a detachment of Federal cavalry, which had previously invaded the state and taken various points of importance.

The history of Georgia, since the war, has been one of steady progress. In the fall of 1865, the ordinance of secession from the statute book was repudiated, acquiesced in and ratified the emancipation proclamation of the

president, and voided all public debts on account of the war. In 1868 a constitution was framed and the state government was organized. Five years after the war Georgia was in full possession of all her rights as a State of the union, and her reconstruction was complete. With energy and pluck her people went to work to retrieve their fallen fortunes and at present no southern state has a brighter future. In national elections the state has invariably gone Democratic. In 1908, a law prohibiting the sale of alcoholic beverages became effective.

The Cotton Exposition of 1881, and the Cotton States and International Exposition of 1898, both held at Atlanta, testified to the prosperity of the state. The division of races continued clean-cut; and though there was no disposition among the better class of whites to hinder the negro in the exercise of his civil rights, political equality was begrudged him, and social equality absolutely denied. As late as 1891 the legislature decreed that separate public conveyances be provided for whites and negroes, and as late as 1897 the appointment of a negro as postmaster was made impossible by public opinion. Instances of mob law and racial feud were frequent after 1894.

In national politics the state was democratic throughout the nineteenth century, except in 1840 and 1848, when it cast its electoral vote for the whig candidate. In state politics, Georgia, since 1874, has been immaculately democratic, and since 1882 the republicans have not participated in the state elections. From 1890 to 1898, however the populist party was very powerful. The present constitution was adopted in 1877, when Atlanta was made the capital. Pop. 1909, 2,675,000.

GEORGIA BARK, a small tree of the southern states closely resembling the cinchona or Peruvian bark, and belonging to the natural order Cinchonaceæ. It has pretty large white flowers, with longitudinal stripes of rose-color, disposed in beautiful clusters at the extremities of the branches; each flower is accompanied with a floral leaf, bordered with rose-color near the upper margin; the corolla is tubular; the stamens five, with a single style; and the capsule contains two cells and numerous seeds. The wood is soft and unfit for use in the arts. The inner bark is extremely bitter, and is employed with success in intermittent fevers.

GEORGIA, GULF OF, a large gulf of the North Pacific Ocean, between the continent of North America and Vancouver's Island; about 120 miles in length from north to south; the breadth varies greatly in its different parts, from 6 miles to 20 . It communicates with the ocean on the north by Queen Charlotte's Sound, and on the south by the Strait of Juan de Fuca.

GEORGIA, University of, an institution of higher education, chartered in 1785, and formally opened at Athens, Ga. in 1801. Its government is vested in a board of trustees appointed by the governor. The proceeds of the sales of lands received by Georgia under the U. States land grant act of 1862 were transferred to the university in 1872, and the university, which in its inception was designed as a classical school has, broadened its scope, and in 1902 comprised: Franklin College; the State College of Agriculture; the Graduate School; the Law School; the North Georgia Agricultural College, situated at Dahlonega; the Medical College, situated at Augusta; the School of Technology situated at Atlanta; the Normal and Industrial School for Girls, situated at Milledgeville; the State Normal School; and the Industrial College for colored persons, which includes a well-equipped trade department.

GEORGIAN BAY, formerly called Lake Manitoulin, the northeastern part of Lake Huron, partly separated from the main body of the lake by the peninsula of Cabot's Head and the island of Great Manitoulin. It is about 120 miles long and 50 broad.

GEOT'ROPISM, in botany, a disposition or tendency to turn or incline towards the earth, as the characteristic exhibited in a young plant when deprived of the counter-acting influence of light, of directing its growth towards the earth.

GEOTRU'PIDÆ, a family of burrowing lamellicorn beetles. They inhabit temperate climates, and are useful in removing disgusting substances. When alarmed they feign death. The watchman-beetle of Britain, is the tpye of the family.

GERANIUM, popular name crane's-bill. They have usually palmately divided leaves and regular flowers with ten stamens and five carpels. An American species, from its astringency called "alum-root," is used medicinally as a gargle and otherwise. Cultivation has produced many varieties, which from their beauty are great favorites.

GERARD (zhā'rär), François Pascal, Baron, a French historical and portrait-painter, born at Rome in 1770; went to Paris (1786), and studied under David. In 1795 he exhibited his first notable painting, Belisarius. He was much patronized by Napoleon, for whom he painted the battle of Austerlitz, and was made a baron by Louis XVIII., after completing his large painting of the Entrance of Henry IV. into Paris. Among his portraits the most famous are those of Tallyrand, Talma, Louis Philippe, Madame Récamier, Mdle. Mars, etc. He died in 1837.

GERBA, or **JERBA,** an island in the Gulf of Cabes, off the coast of Tunis. It is about 20 miles long and 14 broad. The surface is level and fertile, and occupied by a population of 30,000, mostly Berbers.

GERHARD (ger'hårt), Eduard, a German archæologist, born 1795, died 1867. Among his numerous works are the following:—Antike Bildwerke (with 140 plates); Auserlesene Griechische Vasenbilder (330 plates); Etruskische und Campanische Vasenbilder, Griechische Mythologie, etc.

GERHARDT (ger'hårt), Karl Friedrich, German chemist, born 1816. He was the first to introduce the new combining weights, or rather to subject more completely eombination by weight to combination by volume; to originate the theory of types, and to furnish new ideas on classification, homology, and similar subjects. The methods he originated have had a great influence on modern chemistry. He died in 1856.

GERHARDT, Paul, the greatest of German hymn-writers, born in 1607. In 1668 he was made archdeacon in Lübben, where he died in 1670. His excellent book of hymns appeared at Berlin in 1667 (Geistliche andachten). Many particular hymns have found English translators.

GERM, in physiol. the earliest form under which any organism appears, that is the rudimentary or embryonic form of an organism. The name is also given to certain minute organisms which give rise to disease. See Germ Theory.

GERMAIN (zher-man), St., the name of a number of places in France, among which is St. Germain-en-Laye, a town in the department of Seine-et-Oise, about 6 miles north from Versailles and 11 miles w.n.w. from Paris, on the left bank of the Seine. The most remarkable building is the royal palace, commenced by Charles V. in 1370, and embellished by several of his successors, especially Francis I. and Louis XIV. It was used as a prison during the revolution, afterward as a school for cavalry officers, and was ultimately restored in 1862 by Napoleon III., who established in it a museum of Gallo-Roman antiquities. The forest of St. Germain is one of the finest in France, extending over 10,000 acres. Pop. 14,280.

GERMAN'ICUS, Cæsar, a distinguished Roman, son of Nero Claudius Drusus and the younger Antonia, a niece of Augustus, was born B.C. 15. He was adopted by Tiberius, his paternal uncle, and married Agrippina, the grand-daughter of Augustus. When Augustus died, in A.D. 14, Germanicus was invited by the rebellious legions on the Rhine to assume the sovereignty, but refused, and quelled the revolt. He then crossed the Rhine, surprised and defeated the Marsi with great slaughter. Next year (A.D. 15) a campaign against the Catti and the Germans, led by Arminius, resulted in a series of victories. The following year he again made his way into Germany, defeated the Cherusci twice, and made an incursion into the country of the Marsi. Tiberius now became jealous of the glory of Germanicus, called him home under pretense of granting him a triumph, then, to get rid of him, sent him into the East to compose the disturbances in Armenia and Cappadocia. This he performed in A.D. 18, visited Egypt the following year, and died on his return to Syria (A.D. 19) under some suspicion of having been poisoned by Cn. Piso, the governor of Syria.

GERMAN OCEAN. See North Sea.

GERMAN SARSAPARILLA, a name given to certain roots or rhizomes from their being occasionally used in Germany as a substitute for sarsaparilla.

GERMAN SILVER, Nickel Silver, or Packfong, is an alloy of copper, nickel, and zinc in different proportions, among which the following may be mentioned: Spoons and forks are made from 2 parts copper, 1 nickel, 1 zinc; knife and fork handles from 5 copper, 2 nickel, 2 zinc.

GERMANY

SCALE OF MILES

0 20 40 60 80 100

Railroads .....

Submarine Cables .....

Canals .....

Size of type indicates relative importance of places

Hammond's 8 x 11 Map of Germany

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A 6° B 8° C 10° D 12° E 14° F 16° G 18° H 20° J 22° K Longitude East from Greenwich

1 2 3 4 5 Latitude

a mixture closely resembling alloyed silver; addition of lead produces an alloy which appears well fitted for casts, and for making candlesticks, etc.; iron or steel, on the other hand, makes the alloy whiter, harder, and more brittle. German silver is harder than silver, and takes a high polish. It melts at a red heat, the zinc being volatilized in the open air. It is attacked by the strong acids, but it is also affected by common organic acids, such as vinegar, and by some saline solutions.

GERMAN TINDER, or **AMADOU,** is prepared from a fungus growing on the oak, birch, willow, cherry, plum, and other trees. The fungus is removed with a sharp knife, washed, boiled in a strong solution of saltpeter, beaten with a mallet, and dried. In surgery it is sometimes used to stop local bleeding.

GERMANTOWN, a northern suburb of Philadelphia, pleasantly situated on high ground, and containing numerous elegant residences. Here the British, under General Howe, defeated the Americans under Washington, 4th Oct., 1777.

GERMANY, the name given collectively to the states in Central Europe which constitute the German Empire. The limits of Germany have varied greatly at different times; and at present there are large numbers of people Germans in race and language not included within the boundaries of the empire, many being natives of Austria and Switzerland. On the other hand, the political boundaries of Germany contain several millions of Slavs, Lithuanians, Poles, etc. As one of the Teutonic peoples the Germans are akin by race to the Dutch, English, and Scandinavian peoples. The capital of Germany is Berlin; other large towns are Hamburg, Breslau, Munich, Dresden, Leipzig, Cologne. As each state is described under its own name, the description given below is confined to leading features which belong to Germany as a whole. The following table shows the component parts of the empire:—

	Area in square miles.	Population.
KINGDOMS.		
1. Prussia	134,506	34,472,509
2. Bavaria	29,283	6,176,057
3. Würtemberg	7,530	2,169,480
4. Saxony	5,788	4,202,216
IMPERIAL TERRITORY.		
5. Alsace-Lorraine	5,600	1,719,470
GRAND-DUCHIES.		
6. Baden	5,824	1,867,944
7. Hesse	2,965	1,119,893
8. Mecklenburg-Schwerin	5,080	607,770
9. Mecklenburg-Strelitz	1,130	102,602
10. Oldenburg	2,479	399,180
11. Saxe-Weimar	1,390	362,873
DUCHIES.		
12. Brunswick	1,424	464,333
13. Saxe-Meiningen	953	250,731
14. Saxe-Coburg and Gotha	755	229,550
15. Saxe-Altenburg	511	194,914
16. Anhalt	885	316,085
PRINCIPALITIES.		
17. Waldeck	433	57,918
18. Lippe	469	138,952
19. Schaumburg-Lippe	130	43,132
20. Schwarzburg-Rudolstadt	362	93,059
21. Schwarzburg-Sondershausen	332	80,898
22. Reuss (elder line)	122	68,396
23. Reuss (younger line)	318	139,210
FREE TOWNS.		
24. Bremen	98	224,882
25. Hamburg	160	768,349
26. Lübeck	115	96,775
	208,626	56,367,178

Germany, as regards its surface, may be divided into three different regions. Farthest south is the Alpine region along the southern frontier, comprising parts of Bavaria, Würtemberg, and Baden lying next to Austria and Switzerland. North of this the Suabian-Bavarian plateau extends to the mountain region of Central Germany, where the chain known as the Fichtelgebirge is continued east by the Erzgebirge and the Riesengebirge forming the boundary next Austria; west by the Thüringerwald, Rhöngebirge, and Spessart; farther north lie the Harz Mountains. The great plain in the north extends without interruption to the German Ocean and the Baltic. Germany is remarkably well watered. Its central mountain region and plateau forms part of the great water-shed of Europe. The Danube proceeds across it in an eastern direction, and the Rhine, though it neither rises nor terminates within Germany flows within it for the greater part of its course. After these come the Elbe, Oder, Vistula, Weser, Main, Neckar, Mosel, Ems, and Eider—all of them navigable. Germany possesses much and varied mineral riches, the most important minerals being common coal and brown coal, iron, zinc, lead, and salt. Germany is likewise extremely rich in mineral waters, especially in the southern parts. Though the country extends over $8\frac{1}{2}°$ of latitude, its mean annual temperature is remarkably uniform. This is owing mainly to the different elevations of the surface, the low plains of the north having a higher, while the hills and plateaux of the south have a lower temperature than their latitudes might seem to indicate. The mildest climate is enjoyed by the valleys of the Rhine and the Main.

Agricultural products are varied and numerous. With exception of the loftier mountain districts, where the surface is fit only for pasture, the growth of all the ordinary cereals is universal. Potatoes, hemp, and flax also form most important crops, and in many parts sugar-beet, tobacco, and hops are cultivated on an extensive scale. Wine is produced in many districts. The cultivation of the vine diminishes in importance from southwest to northeast, but is carried on to some extent even in the Prussian provinces of Saxony, Brandenburg, and Posen. The forests are of great extent and value, particularly in the mountain districts.

Linens are made in every part of Germany, but more especially in Westphalia, Silesia, Bohemia, and Saxony; woolens in the Prussian provinces of the Rhine, Saxony, Brandenburg, and Silesia, in the kingdom of Saxony, and in Alsace; the cotton manufacture constitutes the chief manufacturing industry in Alsace-Lorraine, the kingdoms of Saxony and Würtemberg, and the grand-duchy of Baden, and flourishes in Bavaria, Prussia, and other parts, the silk manufacture flourishes in the Rhine provinces and in Baden; iron manufactures are carried on in most of the states, but principally in Prussia, Alsace-Lorraine, Bavaria, and Saxony; steel is largely manufactured in the Rhine provinces. The manufactures of beet-sugar, of leather, of metals, porcelain, glass, fancy flowers, hats, musical instruments, watches, clocks, wooden wares, including toys, etc., are likewise important; and breweries and distilleries are to be met with everywhere.

The commerce is very extensive, and is administered and guided by special laws of a union called the zollverein or customs union, which embraces the whole of Germany and also the grand-duchy of Luxemburg. The exports and imports comprise a great variety of manufactured goods and raw products. The manufactures of Germany are now sent to all parts of the world. By far the principal seaport is Hamburg; others are Bremen and Bremerhaven, Stettin, Königsberg, Danzig, Lübeck, etc. The total length of railways is about 28,000 English miles, five-sixths of which are state railways. By the law of Dec. 4, 1871, a uniform gold standard was introduced for the monetary system of the whole German empire. The denominational unit is the mark, nearly equal to 25 cents and divided into a hundred pfennige. Since 1872 the French metrical system of weights and measures has been in force throughout the German empire.

The revenue is derived principally from the customs duties collected throughout the zollverein from excise duties on beet-sugar, salt, tobacco, and malt, and from the contributions made by each state in proportion to its population. The debt of the empire is about $600,000,000.

The constitution of the German empire is based upon the decree of the 16th of April, 1871, which took effect on the 4th of May following. The presidency of the empire belongs to the crown of Prussia, to which is now attached the title of German Emperor (Deutscher Kaiser). The prerogatives of the emperor are to represent the empire in its relation to other states, to declare war if defensive, and conclude peace in name of the empire, to contract alliances etc. The emperor has also the supreme command of the army and the navy, appoints and dismisses officials of the empire, appoints consuls, and superintends the entire consulate of the empire. The legislative authority is vested in the bundesrath (federal council) and the reichstag (imperial diet) the former consisting of 58 representatives of the different states of the empire, namely, 17 from Prussia, 6 from Bavaria, 4 each from Saxony and Würtemberg, 3 each from Baden and Hesse, 1 each from Saxe-Weimer and others. The reichstag consists of 397 deputies elected by ballot and universal suffrage in all the states of the empire. On the average one member is returned to the reichstag for every 124,500 of the inhabitants.

Service in the army or navy is obligatory on every man in Germany who is not morally or physically unfit, and no substitution is allowed. Liability to serve begins from the completion of the seventeenth year, but as a rule, the six years' service required in the standing army (seven in the cavalry and field artillery) is from the twentieth to the twenty-seventh year. Two of the six years (or three as the case may be) must be spent

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in active service, and the remaining four in the reserve. After quitting the army of reserve the next five years are passed in the first-class of the landwehr, and seven in the second. All able-bodied men, from seventeen to forty-five, who are not in the line, the reserve, or the landwehr, must belong to the landsturm, which is called out only in case of invasion of the territory of the empire. Educated young men above seventeen years of age who volunteer for active service, and equip and maintain themselves during their service, are admitted into the reserve after one year's continuous service. The peace strength of the army is about 584,000 men, and the total war strength of trained soldiers 3,000,000. The German navy has been greatly strengthened in recent years, and this is still going on the chief naval bases being Kiel and Wilhelmshaven.

Education is compulsory throughout Germany. Every commune or parish must support at its own cost a primary school. Every town in addition must maintain one or more middle schools, which supply a higher education than the elementary schools. Above these are real schools (realschulen) giving a still higher education, nearly corresponding to the American high school; institutions of similar standing called gymnasiums, giving an education in which the ancient languages form a more important element; and, above all, the universities, of which there are 21 in the country, the chief being those of Berlin, Leipzig, and Munich. The Germans as a whole are perhaps the best-educated people in the world.

The date of the first arrival of the Germanic or Teutonic races in Europe is unknown. At the close of the 2nd century B.C. Germanic tribes called Cimbri and Teutones left their homes in the Danish peninsula, and descending upon Italy were defeated by Marius at Aquæ Sextiæ (Aix in Provence) and Vercellæ in Northern Italy. The Romans did not come again in contact with the Germans till Cæsar's invasion of Gaul brought on a contest with the Suevian prince Ariovistus (58 B.C.) At that time several German tribes had crossed the Rhine and settled in the district between that river and the Vosges Mountains, while others had pushed their way through what is now Belgium. The Germans on the left bank of the Rhine were soon subjugated, and two expeditions were made by Cæsar across the Rhine. Under Augustus a systematic attempt was made to subjugate the vast and little-known region Germania, extending between the Rhine and the Vistula, and from the Danube to the North Sea. Tiberius reduced all the tribes between the Rhine and the Elbe, but a few years later there was a revolt, in which three Roman legions under Varus were annihilated by Arminius, leader of the Cherusci, about 9 A.D. The attempt to subjugate the Germans was given up by Augustus; and Germanicus, although he avenged the defeat of Varus by a succession of campaigns, failed to recover the Roman ascendency. About this time each tribe or nation among the Germans is described as having been divided into four classes:—1. The nobles, from whom the kings and chiefs of the districts were chosen. 2. The freemen, who, with the nobles, had the right to choose their residence and hold heritable property, who formed the chief strength of the armies and voted in the popular assemblies. 3. The freedmen, a middle class between freemen and slaves, had no landed property, but farmed the land; they were not admitted to the popular assemblies. 4. The slaves, who were entirely in the power of their masters. In religion the Germans were polytheists. Among their great gods were Woden (or Odin), Donar (Thor), Thiu (Tyr), Frigga, etc. They erected no temples and had no idols, but believed in a future life and in eternal justice.

As the aggressive force of the Roman empire abated, it continued to be more and more subject to the incursions of the Germans, who by the end of the 5th century had overrun Gaul, Italy, Spain, and part of Africa. After this Germany itself continued in a divided state till it came under the single rule of Charlemagne. (See France.) The history of the German empire properly commences with the Treaty of Verdun (843 A.D.), which separated the land of the Eastern Franks under Ludwig the German from that of the Western and Central Franks. Out of Ludwig's kingdom was developed the German nationality. Charles the Fat became emperor in 881, and three years later was also elected king of the West Franks, thus again uniting under one scepter the monarchy of Charlemagne. After his deposition in 887 the two territories of the Eastern and Western Franks were again separated.

Under Henry III., whose reign began in 1039, the imperial power was at its highest point, and he exercised more despotic authority in Germany than any of his predecessors. The fruits of his policy were lost by his son Henry IV. (1056–1106), who was passionate and weak. In his reign occurred the famous quarrel with the pope regarding investitures, which ended in Henry having to humble himself before the pope at Canossa.

Succeeding monarchs were less and less powerful, the internal divisions of Germany deprived the office of all authority, and until 1273 the German Empire had no real head.

Rudolph, count of Hapsburg and Cyburg, the most powerful prince in Helvetia, was chosen emperor (1272). He enriched his own family by his victories over the King of Bohemia, and acquired Austria, Styria, and Carinthia as imperial fiefs for his sons Albert and Rudolph. Frederick III., (1439–93) was the last emperor who was crowned in Rome. Henceforth the German emperors were always of the house of Austria.

Since its rise the empire had undergone many changes. At the extinction of the Carlovingian dynasty Germany was divided into five nations or dukedoms—Franconia, Suabia, Bavaria, Saxony, and Lorraine. Henry the Fowler and the Ottos added the marches of Austria and Misnia; Henry the Lion and Albert of Brandenburg, Mecklenburg and Pomerania. The house of Austria added Styria, Carinthia, Carniola, and the Tyrol. But Switzerland had been lost, and the old Burgundian territories of the empire, Franche Comté the Lyonnais, and Provence, had gone to consolidate the French monarchy under Louis XI. Bohemia and Hungary, and many of the Italian cities, especially in the north, were also connected with the empire, but the connection was more formal than real, and ten circles established by the Diet of Cologne (1512) represented at that time the estates of the empire, viz.: 1. Austria, 2. Bavaria, 3. Suabia, 4. Franconia, 5. the Upper Rhine (Lorraine, Hesse, etc.), 6. the Lower Rhine, or the Electorates (Mainz, Trier, Cologne), 7. Burgundy (Netherlands), 8. Westphalia, 9. Lower Saxony (Brunswick, Lüneburg, Lauenburg, Holstein, etc.), 10. Upper Saxony (Saxony, Brandenburg, Pomerania, etc.).

The chief political machinery of the empire was connected with the diet. The exact constitution of the early German diets is not known. In the 12th century the counts of the empire became distinguished from the princes, and lost the right of voting in the diets. The election of an emperor was at first undertaken by the whole diet. In the 13th century the number of electors was restricted to seven, to which two more were afterward added. The diets were called by the emperor at his own pleasure, but as they had the power of granting supplies their meetings were frequent; and as their authority over the different states was partial, and their policy could only be carried out by the executive force of the emperor, they can hardly be regarded as an independent power in the state. Neither the time nor the place of meeting of the diets was at first fixed. From an early period the cities of Germany were represented in the diet. In early times they generally supported the authority of the emperor, as their interest was common with his in diminishing the power of the greater vassals. Municipalities were at first established about the reign of Frederick I., and soon began to assert their independence. The predatory habits of the nobles, besides the claims of superiority over entire cities or particular citizens asserted by the princes involved the cities in continual warfare with the feudal nobility, and often also with their ecclesiastical superiors. The necessity of defending their privileges compelled them to enter into leagues among themselves. Among the earliest of these combinations was the Hanseatic league, formed to resist both the oppression of rulers and the depredations of land and sea robbers. A league was formed in 1255 by more than sixty cities in the Rhine, headed by the three ecclesiastical electors, to resist the depredations of the lesser nobles. The Suabian League, formed in 1376, was of similar origin. These leagues were met by counter associations of nobles and princes.

The reign of Charles, the most important in the German annals and the most brilliant in the 16th century, was divided among three great conflicts—the continued struggle between France and

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Germany, the conflict with the encroaching Ottoman empire, and that with the Reformation. Germany was devastated for thirty years by a religious war, hence called the Thirty Years' war.

The invasion of Germany by Christian IV. of Denmark in 1625, the peace of Lübeck (1629), the invasion of Gustavus Adolphus (1630), the battles of Leipzig in 1631, of the Lech and Lützen in 1632, of Nördlingen in 1634, the war with France in 1635, belong to the history of the Thirty Years' war (which see). As its outcome greater power was given to the Protestants; and the right of the princes and states to make war and alliances among themselves or with foreigners was recognized.

The league of Augsburg, in which the emperor, Leopold I., joined, led to a protracted war with France, which was concluded by the Peace of Ryswick. In 1692 the emperor erected Hanover into an electorate, and in 1700 he permitted the Elector of Brandenburg, Frederick III., to take the title of King of Prussia. The war of the Spanish Succession, in which Great Britain, Holland, and the empire were leagued against France, was begun in 1702. To it belong the victories of Marlborough and Eugene (Blenheim, Oudenarde, Malplaquet). The alliance against France was dissolved by the Peace of Utrecht in 1713, to which the emperor refused to accede, and was left alone against France. After a brief campaign between Prince Eugene and Villars he acceded to the Treaty of Rastadt, negotiated between these commanders, 7th March, 1714. The Spanish Netherlands, and Naples, Milan, Sardinia, and other Italian conquests were left to the emperor. Having no male heirs Charles had promulgated in 1713 the Pragmatic Sanction, regulating the succession to his hereditary dominions in favor of his daughters in preference to those of his brother, Joseph I. He died in 1740. Charles Albert, elector of Bavaria, son-in-law of Leopold I., got himself chosen emperor (as Charles VII). in 1742. He laid claim to the hereditary possessions of the House of Austria, and entered into an alliance with France, Spain, Prussia, etc., against Maria Theresa, daughter of Charles VI. But he died in 1745, and Francis I., grand-duke of Tuscany, the husband of Maria Theresa, was elected emperor; thus the house of Hapsburg-Lorraine, which had succeeded to the hereditary possessions of Austria, was recognized as the head of the empire. After a brief interval took place the Seven Years' war (1756–63), in which Austria, Russia, France, and Saxony combined against Prussia, then ruled by Frederick the Great. The peace of Hubertsburg (15th Feb., 1763) concluded the war, Prussia retaining her acquisitions. In 1804 Francis II. took the title of hereditary Emperor of Austria, renouncing two years later that of head of the German Empire, which, indeed, had ceased to exist, owing to the conquests of Napoleon.

The States of Germany were again united by the treaty of Vienna (1815), in a confederation called the German confederation (der Deutsche Bund). In 1818 a general commercial league, called the zollverein, was projected by Prussia, and was gradually joined by most of the German states, exclusively of Austria. Revolutionary outbreaks caused great disturbances in various German states in 1830 and 1848, particularly the latter. The German diet was restored in 1851 by the efforts of Prussia and Austria, who were latterly rivals for the supremacy in the confederation. In 1866 the majority of the diet supported Austria in her dispute with Prussia respecting the disposal of the duchies of Schleswig and Holstein, whereupon Prussia withdrew from the confederation and declared it dissolved. The Seven Weeks' war between Austria and Prussia ended in the defeat of the former the loss of her Italian possessions, and her exclusion from the German confederation, which was re-formed by Prussia under the title of the North German confederation. After the Franco-German war (which see), in which the South German States, as well as the North German confederation, supported Prussia, the King of Prussia was proclaimed German Emperor at Versailles on 18th January, 1871. The parliament of the new German Empire met at Berlin on 21st March, and adopted the new constitution. Since the unity of the empire was attained endeavors have been made to establish a colonial empire, principally in Africa. In Polynesia Germany has acquired a portion of New Guinea, the chief Samoan islands, and other groups. In recent years the manufacturing industries and foreign trade of the empire have developed greatly, and the present emperor (William II.) is bent on making Germany a great naval power.

German is one of the Teutonic family of languages, of the Aryan or Indo-European stock, and hence is a sister tongue with Gothic, Anglo-Saxon and English, Dutch, Danish, Swedish, and Icelandic. The German dialects spoken in the lower and more northern localities have long exhibited considerable differences from those spoken in the higher and more inland, thus giving rise to the distinction between High German and Low German. What is ordinarily called German (called Deutsch by the Germans) is High German. Low German includes Dutch, Frisian, etc.

German literature received its first impulse from the fondness of the early Germanic races for celebrating the deeds of their gods and heroes. According to Tacitus the warriors would advance to attack chanting wild war-songs, with their shields held close to their mouths, which added to the discordant effect of the unknown and uncouth tongue. Of these early songs nothing even in a translated form has been handed down to us. The legends immediately connected with the Gothic, Frankish, and Burgundian warriors of the period of national migration—Dietrich (Theodoric), Siegfried, Hildebrand, etc.—have for the most part some historical foundations, and many of them were eventually incorporated in the Nibelungenlied, the most celebrated in production of German mediæval poetry.

In the 13th century under the cultured emperors of the house of Hohenstaufen, the first bloom of German literature came. Many of the poets of this period were nobles by birth, some of them even princes. Heinrich von Weldeke was the first to introduce into his heroic poem Eneit that spirit of devotion to women, called by the old Germans Minne (Love, hence the name Minnesänger, Love-Minstrel). A still greater name is that of Wolfram von Eschenbach, the author of Parsival, a poem embodying the legends of King Arthur, the Knights of the Round Table, and the San Graal (Holy Grail). These traditions, together with the exploits of Charlemagne, of Alexander the Great, and the Trojan heroes, inspired also the lays of Gottfried of Strasburg, Hartman von der Aue, and others. These subjects were all taken from the romances of the French trouvères, and treated in a style closely resembling theirs. But we have besides real national epics in the Nibelungenlied and Gudrun. The lyrics or minnesongs of this period are not less remarkable than its romances and epics. Perhaps the most gifted lyrist is the celebrated Walther von der Vogelweide. Several hundreds of these poets were engaged in traveling from palace to palace and from castle to castle. During the troublous times of the interregnum (1256–73) poetry passed to the homes of the private citizen and the workshops. These plebeian songsters formed themselves into guilds in the imperial cities—Nürnberg, Frankfort, Strasburg, Mainz, etc., and were called Meistersänger, in contradistinction to the knightly Minnesänger.

The invention of printing caused an increasing literary activity, and the works printed in Germany between 1470 and 1500 amounted to several thousand editions.

In the 16th century a new era opens in literature with Luther's translation of the Bible. The writings of Luther, Zwingli (1484–1531), Sebastian Frank (1500–45?), Melanchthon (1497–1560), Ulrich von Hutton (1488–1523), one of the chief writers of the Epistolæ Obscurorum Virorum, constitute the principal theologic literature of the Reformation. History was now written in a superior style, and with greater comprehensiveness, by Frank in the Zeitbuch and Weltbuch, and by Sebastian Münster (1489–1552) in his Kosmographie; also by Tschudi (1505–72) in Chronicles of Switzerland, and by Aventinus (1477?–1534), the Bavarian chronicler.

By the beginning of the 17th century literature was on the decline. This century is known in German literature as the period of imitation. Most of the poets were graduates of universities; and learned societies were formed for the purpose of improving the language and literature.

In the 18th century poetry revived with Haller (1708–77), remarkable as a descriptive poet, and Hagedorn (1708–54), a lyrist of considerable merit. The Saxon school headed by Gottsched (1700–66) aimed at a reformation of German poetry in the direction of French clearness and correctness, modeling the drama as far as possible on the works of Corneille and Racine.

Gotthold Ephriam Lessing (1729–81) gave a new direction to German literature. He established a new school of criticism and dealt the fatal blow at French influence. His tragedy, Emilia Galotti, his comedy of Minna von Rarnhelm, and his philosophic drama Nathan der Weise, were the best models of dramatic composition which German literature had yet produced, and his direction of the German mind toward Shakespeare and the English drama was not the least of the many impulses he contributed to the literary growth of his countrymen. Herder (1744–1803), with his universal knowledge and many-sided activity, followed Lessing as another great influence in the literary world. The researches of Winckelmann (1717–68) in ancient sculpture led to a new understanding of art, as those of Heyne in ancient literature mark the development of modern German scholarship.

This period was followed by a time of transition and excitement known in Germany as the sturm-und-drang periode (storm and stress period), which found its fullest expression in an early work of Goethe's (1749–1832), the Sorrows of Werther. The literary excitement was raised to the highest pitch by the Räuber (Robbers) of Schiller (1759–1805), afterward the friend and coadjutor of Goethe. By the joint exertions of these two great men German literature was brought to that classical perfection, which, from a purely local, has since given it a universal influence. Of a highly individual character are the works of Jean Paul Richter (1763–1825), a writer of profound humor and pathos.

Partly produced by the influence of the sturm-und-drang period, and partly trained in the laws of art laid down and worked out by Goethe and Schiller, the so-called romantic school, distinguished by its enthusiasm for mediæval subjects and its love of what is mysterious and transcendental in life or thought, gradually succeeded in gaining public attention about this epoch.

The war of liberation against Napoleon I. introduced a strong manly enthusiasm for a time into the hitherto gloomy and melancholy productions of the romanticists. Among the patriotic poets of the time Ernst Moritz Arndt (1769–1860) and Theodor Körner (1791–1813) hold the first place. The ballads and metrical romances of Ludwig Uhland (1787–1872) have brought him a world-wide fame. During the excitement produced by the July Revolution in France (1830) a school of writers arose in whose works the social and political ideas of the time were strongly reflected. The most prominent names among this party are Ludwig Börne (1786–1837) and Heinrich Heine (1799–1856), whose writings combine the keenest satire and the finest pathos. As in England and France of late, the novel, especially the novel, of a social or political character, has taken a prominent place in literature. Most distinguished are Freytag, Spielhagen, Heyse, Auerbach, Fanny Lewald, Hackländer, Reuter, Jensen, Storm, Rosegger, etc. Of late, however, science and learning rather than literature and the arts have produced the names of most eminence. Alexander von Humboldt (1769–1859) gave a great impulse to almost all branches of knowledge by his Cosmos, his Travels, and his Views of Nature, and by the general suggestiveness of his labors. In history, Niebuhr and Theod. Mommsen, the historians of Rome; Leopold Ranke, the historian of the Popes; Dahlmann, Giesebrecht, Julian Schmidt, H. Kurz, and others may be mentioned. German modern theology and biblical criticism had lately much influence in the religious world. Gaur, Bleek, and Ewald, are among the widely-known names. Histories of art have been written by Kugler, Burckhardt, Lübke, and others. The brothers Grimm—Jakob (1785–1863), Wilhelm (1786–1859), were the founders of a new branch of philological and poetic investigation in ancient German literature. Eminent names in general philological science are those of Bopp, Pott, Schleicher, Steinthal, and Karl Brugmann. In natural sciences Oken, Burmeister, Carus, Cotta, Liebig, Helmholtz, Virchow, Schleiden, Griesebach, Vogt, Bessel, Brehm, Häckel, Bastian, etc., are the eminent names; in philosophy, Schopenhauer, Feuerbach, Rosenkranz, Kuno Fischer, von Hartmann, Lotze, etc. Among recent poets Anastasius Grün (pen-name of Count von Auersperg) and Nikolas Lenau among Austrian, and Meissner and Hartmann, natives of Bohemia, have a considerable reputation. Hervegh, Hoffmann, von Fallersleben, Freiligrath, and Franz Dingelstedt infuse strong political sentiments into their poetry. Emmanuel Geibel, Von Scheffel, Bodenstedt, and others represent a poetry more comprehensive in its aims and tendencies.

GERMINAL VESICLE, (a) in animal physiol. the nucleus of the ovum or egg of animals. It contains within it a nucleolus called also the germinal spot. The germinal vesicle undergoes important changes in the early stages of the development of the egg into the embryo. (b) In bot. a cell contained in the embryo sac, from which the embryo is developed.

GERMINATION, the first act of growth by an embryo plant. The immediate causes of germination are the presence of moisture and atmospheric

Seeds germinating. (In centre a plant which has newly appeared above ground.)

air and a certain elevation of temperature. Moisture softens the integuments of the seed and relaxes the tissue of the embryo; atmospheric air supplies oxygen and nitrogen; and a temperature which must be at least as high as 32° Fahr., by exciting the vitality of the embryo, enables it to take advantage of the agents with which it is in contact. During germination various changes take place in the chemical constituents of the seed, and are usually accompanied with increase of temperature, as is seen in the process of malting. Along with these other changes commonly take place; a root is produced, which strikes perpendicularly downward and, fixing itself in the soil, begins to absorb food; a growth upward then commences and ends in the protrusion of a stem and leaves.

GERM THEORY OF DISEASE, the theory that certain diseases are communicated from an infected person to an uninfected one by living organisms which gain access to the body of the afflicted person by the air or food, or drink, and which, growing and multiplying in the body they invade, produce the changes characteristic of the particular disease. The period during which the living particles of contagious matter retain their vitality, like the rate of their growth and multiplication, varies in different cases, but is limited in all. Few, if any, resist the destructive influence of a temperature of 300° Fahr., while most succumb at the temperature of 200° or even less, particularly if exposed for sometime. Animal poisons generally are destroyed by boiling, and clothes, sheets, etc., infected, may be rendered pure by being exposed to a temperature of 300° Fahr. These living organisms are grouped together as microbes or micro-organisms, and are divided into different classes. The micrococcus is a round form about the 32,000th of an inch in size, and multiplies by fission. The bacterium is rod-shaped, about the 10,000th of an inch long, with rounded ends; it also multiplies by fission. The bacillus is a third form also rod-shaped, and somewhat larger than the bacterium. They often form long chains or threads, and increase by division and by spore formation. Vibrio and spirillum are somewhat similar forms; and, like the others, increase with a rapidity beyond conception. The connection between these micro-organisms and the various forms of zymotic disease has been thoroughly established. The only method of investigation that yields reliable results is to separate the organism supposed to be the cause of the disease, and cultivate it outside of the body. Thus a drop of blood from a person suffering from a special disease, which contains the bacteria, or bacilli, etc., believed to be the producers of the disease, is placed in a flask containing a nourishing material, care having been taken to destroy all other organisms in the flask. The special microbe flourishes there, let us suppose. It is then cultivated in one flask after another through successive generations, only a single minute drop of the material in one flask being used to inoculate a succeeding one. In this way a pure cultivation is obtained, a cultivation, that is, containing the particular microbe and none other. If this is the true cause of the disease, then a drop of the solution containing it introduced into the body of an animal, capable of the disease ought to produce it, and the particular organism introduced should be found

multiplying in the blood and tissues of the inflected animal. Such a demonstration has been given of the cause of a few diseases. Dr. Koch, of Berlin, published in 1876 a paper giving a full account of the life history of the bacillus organism which had been observed in animals dead of splenic fever; and in 1877 the great French chemist, Pasteur, proceeded to investigate the subject, and his investigations conclusively support the germ theory of disease. In 1882 Dr. Koch, of Berlin, announced the discovery of a micro-organism in tuberculosis, a disease believed to be the chief, if not the only, cause of consumption of the lungs. These microbes are found not only in the lungs of persons who have died of tubercle, but also in the spit of tubercular and consumptive patients, and multiply also by spores. Thus it is that the spit of a consumptive patient, even after it has dried up, may be capable of imparting the disease, owing to spores being scattered in the air. After the epidemic of cholera in Egypt in 1883 which spread to France and Italy, investigations were undertaken by French, German, and British commissioners. Dr. Koch detected a peculiar bacillus, shaped like a comma (,), in the intestines of persons who had died of cholera, in the discharges from cholera patients, etc. He believed that this bacillus was the active agent in the production of the disease; but other authorities were unable to accept Dr. Koch's view that the comma-bacillus was the cause of the disorder. All investigation, however, seems to point to the fact that every infectious or contagious disease is due to some form of micro-organism, and that there is one particular organism for each particular disease. Each organism produces its own disease and none other; and the special disease cannot arise unless its germ has gained entrance to the body. The channels through which these germs obtain entrance are innumerable, but they have one origin and one only, and that is a preceding case of disease. The "germ" theory affords the hope and suggestion of a method of diminishing, if not of getting rid of, such diseases altogether, and to some extent also indicates the direction which in their cure is to be sought. If the particular microbe of each contagious disease were known, the condition of its life and activity understood, there is great probability that its multiplication in the living body could be arrested, and the disease thus cured. Even without such knowledge, however, the germ theory indicates that the means for arresting the spread of contagious diseases and diminishing their occurrence consist in preventing the spread of the germs from an existing case of disease. See Disinfectant.

GEROME (zhā-rōm), Jean Léon, a French painter, born in 1824 at Vesoul. Among the chief works of Gérôme are: Louis XIV. and Molière, Death of Cæsar, The Plague at Marseilles, Rex Tibicen, L'Eminence Grise, and various scenes from Oriental life. M. Gérôme received the Prussian order of the Red Eagle and was a commander of the legion of honor. He died in 1904.

GERONA (hā-rō'nȧ), a fortified town of n.e. Spain, capital of the province of Gerona, in Catalonia, at the confluence of the Oña and the Ter, 52 miles northeast of Barcelona. Pop. 16,081.—The Province, area 2270 sq. miles, abuts on the Mediterranean, is mountainous and mostly rugged, but with many fertile valleys. Pop. 299,287.

Jean Léon Gérôme.

GERRY (gĕr'rĭ), Elbridge, American statesman, was born at Marblehead, Mass., in 1744. In May, 1772, he entered upon his long political career as a member of the general court of Massachusetts and here immediately identified himself with the partiot party. He was re-elected in 1773; was soon afterward appointed by the legislature, with Hancock and Orne, a member of the committee of correspondence. In 1776 Gerry was elected to the continental congress, and was conspicuous as a vigorous advocate of the declaration of independence, which he signed. In 1787 was sent as one of the Massachusetts delegates to the constitutional convention at Philadelphia, where he was prominent as an opponent of the constitution as finally adopted, refusing, along with Randolph and Mason, to affix his signature. He was several times defeated for governor of Massachusetts, but was successful in 1810, and in 1811 was re-elected. His administration was fiercely criticised by the federalists on the ground of its alleged partisanship, and color was given to the charge by the enactment by the republican legislature of a law, which Gerry signed, but of which he seems to have disapproved, for redistricting the state in such a manner as to annihilate the federalist majorities in several counties. (See Gerrymander.) From 1813 until his death, on November 23, 1814, he was vice-president of the United States.

GERRY, Elbridge Thomas, American lawyer and philanthropist, born in New York City in 1837. He became prominently connected with numerous reformatory and benevolent organizations, and in 1874 founded the society for the prevention of cruelty to children. In 1886 he was chairman of the commission which advocated the abolition of the gallows and the substitution of electricity for capital punishment in New York.

GERRYMANDER, (gĕr'rĭ-măn'der), a word belonging to the political vocabulary of the U. States, and used to denote an unfair division of the electoral districts in a state, made in the interest of one of the political parties. The word was coined in 1812, though the practice probably originated earlier. At that time the federalist and republican parties in Massachusetts were nearly evenly balanced in numerical strength, but the republicans took advantage of a temporary majority in the legislature to divide the state into new senatorial districts in such a manner that those sections which gave a large number of federalist votes might be brought into one district. Previously each county had constituted a senatorial district, and the power of rearranging old districts or creating new ones, bestowed on the legislature by the state constitution, had never been exercised. Elbridge Gerry was at that time governor, and through his signature, though he seems not to have wholly approved the measure, the work of the legislature became a law. The form of one of the districts into which Essex County was divided was somewhat like that of a monstrous animal, and when some one suggested that it looked like a salamander, the name "gerrymander" was given to it, instead. The passage of the law caused a great outcry from the federalists, and early in 1813, this party having again secured a majority and elected a governor to succeed Gerry, the law was repealed. The device, however, has since been repeatedly used in various states.

GERS (zhār), a department in the s.w. of France, separated from the Bay of Biscay by the department of Landes; area, 2425 sq. miles. The southern part is covered with ramifications of the Pyrenees separated by valleys, each of which is watered by its own stream. The chief of these are the Gers, Losse, Save, etc. Auch is the capital. Pop. 238,448.

GESNER (ges'nĕr), Konrad von, German scholar, born at Zürich in 1516, studied at Strasburg, Bourges, and Paris and became schoolmaster in his native town. His Historia Animalium must be regarded as the foundation of zoology; and in botany he was the inventor of the method of classifying the vegetable kingdom according to the characters of the seeds and flowers. He died of the plague at Zürich, 1565.

GESSLER. See Tell.

GESTATION, in physiology, the name given to the interval which elapses between the impregnation of any of the mammalia and the period of birth. This period varies from 25 days, in the case of the mouse, to 620, in that of the elephant.

GETHSEMANE, an olive garden or orchard in the neighborhood of Jerusalem, memorable as the scene of the last sufferings of Christ. The traditionary site of this garden places it on the east side of the city, a very little beyond the Kedron, near the base of Mt. Olivet. It contains some very old olive-trees, piously regarded as having stood there in the time of our Lord.

GETTYSBURG, the capital of Adams co., Pennsylvania. Here are the Pennsylvanian college (Lutheran), founded in 1832; the national cemetery for Union soldiers, and a national homestead for the orphans of Union soldiers. At Gettysburg a battle was fought (July 1, 2, and 3, 1863,) between the Union forces under

General Meade and the confederate forces under General Lee, in which the latter suffered a disastrous defeat.

GEYSERS, a slight alteration of the Icelandic name geysir, from geysa, to gush or rush forth, and applied to natural springs of hot water of the kind that were first observed in Iceland. The geysers of Iceland, about a hundred in number, lie about 30 miles n.w. of Mount Hecla, in a plain covered by hot-springs and steaming apertures. The two most remarkable are the Great Geyser and the New Geyser or Strokkur (churn), the former of which throws up at times a column of hot water to the height of from 80 to 200 feet. The basin of the Great Geyser is about 70 feet across at its greatest diameter. The New Geyser which is only 100 yards distant, is much inferior in size. The springs are supposed to be connected with Mount Hecla and the phenomenon of eruption has been explained by Tyndall as due to the heating of the walls of a fissure, whereby the water is slowly raised to the boiling point under pressure, and explodes into steam, an interval being required for the process to be repeated. The geysers of Iceland, however, have been surpassed by those discovered in the Rocky Mountains in the Yellowstone Region of Wyoming Territory, the largest of which throw up jets of water from 90 to 250 feet high. (See Yellowstone.) The hot-lake district of Auckland, New Zealand, is also famous in possessing some of the most remarkable geyser scenery

Giant geyser, Yellowstone national park.

in the world. These phenomena are of three kinds: the puias (fire-springs), geysers continually or intermittently active; ngawhas or inactive puias, which emit steam, but do not throw up columns of water; and waiariki or hot-water cisterns. This region is remarkable for the number of natural terraces containing hot-water pools or cisterns, and its lakes all filled at intervals by the boiling geysers and thermal springs, but the configuration of the country was considerably altered by the disastrous volcanic outbreak of 1886. Ngahapu or Ohopia, a circular rocky basin, 40 feet in diameter, in which a violent geyser is constantly boiling up to the height of 10 or 12 feet, emitting dense clouds of steam, is one of the natural wonders of the southern hemisphere.

GHATS (gāts), or **GHAUTS,** a Hindu term employed to designate landing-stairs on a river, especially when large and substantially constructed. These

Ghoosla ghat, Benares.

ghâts are very numerous on the Ganges, and are great places of resort by the people of the towns where they are situated. Some of them are noteworthy from an architectural point of view, having temples, bathing-houses, etc., at the top.

GHATS, or **GHAUTS,** Eastern and Western, two ranges of mountains in the peninsular portion of Hindustan, the former running down the east side of India, but leaving broad tracts between their base and the coast; the latter running down the west side, but leaving only a narrow strip between them and the shore. Both meet near Cape Comorin. The general elevation of the Western Ghâts varies from 4000 to 7000 feet. The Eastern Ghâts are of considerably less elevation, on the average about 1500 feet, and have none of the beauty of the western range. They are, however, rich in metals.

GHAZIPUR, a town in Hindustan, headquarters of the Ghazipur District, in the United Provinces, about 44 miles northeast of the town of Benares. Pop. 39,429.

GHEE (gē), or **GHI,** a peculiar kind of butter in use among the Hindus. It is made from the milk of the buffalo or the cow. The milk is boiled for an hour or so, and cooled, after which a little curdled milk is added. Next morning the curdled mass is churned for half an hour; some hot water is then added, and the churning continued for another half-hour, when the butter forms. When, after a few days, it becomes rancid, it is boiled till all the water is expelled, and a little more curdled milk added with some salt or betel-leaves, after which it is put into pots. In this state it will keep for a long time. It is too strong for European taste, but is a favorite article of consumption among rich Hindus.

GHENT, a town in Belgium, capital of the province of East Flanders, in a fertile plain at the confluence of the Lys with the Scheldt. It is upwards of 6 miles in circumference, and is divided by canals into a number of islands connected with each other by bridges. In some of the older parts it is well built, and has a number of fine promenades and many notable buildings. Among the latter are the cathedral of St. Bavon, a vast and richly-decorated structure, dating from the 13th century; the church of St. Nicholas, the oldest in Ghent; the church of St. Michael, with a celebrated Crucifixion by Vandyk; the university, a handsome modern structure, with a library of about 200,000 volumes and 2500 MSS.; the hôtel-de-ville; the belfry, a lofty square tower surmounted by a gilded dragon, and containing a fine set of chimes consisting of forty-four bells, one of which is the famous "Roland of Ghent;" the new palais-de-justice; the marché du vendredi, an extensive square, interesting as the scene of many important historical events; and les béguinages, extensive nunneries founded in the 13th century, the principal occupation of whose members is lace-making. Ghent has long been celebrated as a manufacturing town, especially for its cotton and linen goods and lace. Pop. 160,848.

GHENT, Treaty of, a treaty between the U. States and Great Britain which ended the war between the two countries known as the "War of 1812." The American negotiators were John Quincy Adams, James A. Bayard, Henry Clay, Jonathan Russell, and Albert Gallatin. The British representatives were Lord Gambier, Henry Goulburn, and William Adams. The treaty was signed on December 24, 1814, was ratified by the U. States senate on February 17, 1815, and was formally proclaimed by President Madison on the following day.

GHETTO (get'to), a name used in different towns of Italy, Germany, and other countries to indicate the quarter set apart for the residence of Jews.

GHIBERTI (gē-ber'tē), Lorenzo, Italian statuary, born about 1378 at Florence. He was engaged in painting frescoes at Rimini, in the palace of Pandolfo Malatesta, when the priori of the society of merchants at Florence invited artists to propose models for one of the bronze doors of the baptistery of San Giovanni. The judges selected the works of Donatello and Ghiberti as the best (according to Vasari, also that of Brunelleschi, who is not mentioned by Ghiberti himself as one of the competitors); but the former voluntarily withdrew his claims, giving the preference to Ghiberti. After twenty one years' labor Ghiberti completed the door, and, at the request of the priori, executed a second, after almost as long a period. Michael Angelo said of these, that they were worthy of adorning the entrance to paradise. During these forty years Ghiberti also completed other works, bas-reliefs, statues, and some excellent paintings on glass, most of which may be seen in the cathedral and the church of Or San Michele at Florence. He died about 1455.

GHILAN (gi-lân'), a province of Persia on the southwest shore of the Caspian Sea; area, about 4250 sq. miles. The province is rich in metals and very fertile. The capital is Resht. Pop. about 150,000.

GHOST, HOLY. See Holy Ghost.

GHOSTS, the belief in ghosts is one of the earliest of all religious phenomena. It is found in one form or another at all ages and among all peoples. To such an extent does belief in ghosts prevail, that one school of comparative religion

of whom Herbert Spencer and Julius Lippert are the chief representatives, has sought to find the origin of all religion in ghost-cults. The importance of ghost-worship as a religious factor cannot be denied, and it is certainly one of the main sources of religious belief. Its chief development is found in the widespread existence of ancestor-worship.

The ghost idea in its most primitive form seems to be as follows: The phenomenon of dreams is one of the starting-points. According to the reasoning of the primitive mind, the self, while the body is unconscious and inert, wanders to places familiar or even unknown, experiences pleasure and pain, converses with friends perhaps dead, and performs other things which have no connection with the body. From sleep and dreams the savage proceeds by analogy to death. To him the distinction between slumber and death is one of degree rather than of kind, and it is well known how universal is the belief that sleep and death are near akin. As in slumber the soul left the body for a time, but returned to it, so in the long sleep, as the primitive mind regards it, of death, the soul is supposed to remain near the body. As it is obviously impossible to keep a corpse from dissolution, and as the progress of decay renders the body more and more uninhabitable for the spirit which has left it, the soul, or the ghost as it may now be called, becomes a source of much anxiety to the kinsman and other friends of the dead. In primitive religion the element of terror is one of the most important factors, and at first exercises a far greater influence than hope. The ghost is, then, more terrible than was the man whose body it had animated. It is no longer limited by bodily restrictions, it can traverse space with infinite speed, and may be invisible. Fortunately, and somewhat curiously, the ghost, like demons generally, is rather stupid, and is also bound by certain limitations. Upon such an apparently flimsy foundation, which is, however, logical to the primitive man, is built a complicated system of mortuary customs, and the idea of immortality. The ghost, which, as has been said, delights to hover around its earthly home, is not a cheerful companion to the living, and must therefore be kept away. This is accomplished by various methods as by building a new hut for the survivors, or, more easily, by carrying the corpse out by a hole broken in the side of the dwelling, which is subsequently walled up. The ghost is then unable to find its way back, and the house is safe from its invasion. The superstition here noted still survives. The so-called haunted houses and haunted rooms are cases in point, and it is important to note that it is the malignant ghosts, chiefly those who have been involved in murder or other evil acts, which especially linger around the scene of their earthly activities. To avert the influence of maleficent ghosts, various forms of sacrifice and magic are employed. These ceremonies have as their primary object the satisfaction of the ghost's wants. Thus the bow and arrows are laid with the warrior, a woman's jewelry is buried with her, and a child's toys rest beside its body. It was also common in many places, notably in Dahomey and Polynesia, to sacrifice slaves to attend their master in the spirit world, while among the ancient Germans horses and even wives (as in the Indian suttee) were often slain at the funeral pyre. It is also probable that to wish to appease ghosts many of the elaborate mourning customs of primitive peoples may be traced. Under this category come such acts as shaving the hair, cutting the flesh, fasting, neglect of the toilet, use of unbecoming clothing, and the like. It is, of course, true that at a comparatively early time the development of civilization rendered mourning for the dead an act of affection and not of fear; but it is hard to believe that the savage who put to death the aged members of his tribe was moved by any high ideals in the beginning of mortuary customs. In line with mourning are the offerings of food, drink, clothing, and, as in China, of money to the deceased.

GIANT POWDER, a name for dynamite.

GIANTS, people of extraordinary stature. History, both sacred and profane, makes mention of giants, and even of races of giants, but this in general occurs only at an early stage of civilization when the national mind is apt to exaggerate anything unusual. The first mention of giants in the Bible is in Gen. vi. 4, where the Hebrew word used is nephilim, a word which occurs in only one other passage, where it is applied to the sons of Anak, who dwelt about Hebron, and who were described by the terrified spies as of such size that compared with them they appeared in their own sight as grasshoppers. A race of giants called the Rephaim is frequently mentioned in the Bible, and in Gen. xiv. and xv. appear as a distinct tribe, of whom Og, king of Bashan, is said to have been the last. Other races of giants are mentioned, such as the Emim, the Zuzim, and the Zamzummim. The giants of old Greek or of Norse mythology have, of course, merely a symbolic existence, representing benignant or adverse forces of nature on which man might count in his struggle to reduce the world around him into some kind of order. The tales of old writers regarding gigantic human skeletons have now no importance, it being most certainly that these bones do not belong to giants, but to animals of the primitive world which, from ignorance of anatomy were taken for human bones. The ordinary height of men is between 5 and 6 feet; among the Patagonians of South America, however, the average seems to be considerably higher, though not so high as to entitle them to be considered a race of giants. Notable deviations from this medium height are not at all uncommon, especially among the Teutonic peoples. As a rule giants are comparatively feeble in body and mind, and are short-lived. Gigantic stature is generally accompanied by a want of proportion in parts, some parts growing too quickly for others, or continuing to grow after the others have ceased. The relation between the upper and lower half of the body is not disturbed; but the skull, brain, and forehead are relatively small, the jaws very large, the shoulders, breast, and haunches very broad, and the muscular system comparatively weak.

GIANT'S CAUSEWAY, an extensive and extraordinary assemblage of polygonal and basaltic columns on the north coast of Ireland, in the county of Antrim between Bengore Head and Port Rush. The name is sometimes given to the whole range of basalt cliffs along the coast, some of which reach the height of 400 or 500 feet; but it is more properly restricted to a small portion of it where a platform of closely arranged basalt columns from 15 to 36 feet in height runs down into the sea in three divisions, known as the Little, the Middle, and the Grand Causeway. The last is from 20 to 30 feet wide, and stretches some 900 feet into the sea. The Giant's Causeway derives its name from the legend that it was built by giants as a road which was to stretch across the sea to Scotland. There are similar formations on the west coast of Scotland, on the islands of Staffa.

GIBBON, a name common to the apes which inhabit the islands of the Indian Archipelago. It is distinguished from other quadrumanous animals by the

Gibbon.

slenderness of its form, but more particularly by the extraordinary length of its arms, which, when the animal is standing, reaches nearly to the ankles, and which enables it to swing itself from tree to tree with wonderful agility. Its color is black, but its face is commonly surrounded with a white or gray beard.

GIBBON, Edward, an eminent English historian, was born at Putney in Surrey, April 27, 1737. In 1770 he published a pamphlet entitled Critical Observations on the Sixth Book of the Æneid. In 1776 the first quarto volume of his Decline and Fall of the Roman Empire was published, and at once made a public reputation for its author. In 1778 he drew up on behalf of the English government a Mémoire Justification in answer to the manifesto of the French court, and for this service he was made one of the lords of trade. On the retirement of North he lost his appointment, and soon after withdrew to Lausanne (1783), where, in the course of four years, he completed the three remaining volumes of his history, which were published together in 1788. In 1793 he returned to England, where he died 16th

January, 1794. In 1796 his friend Lord Sheffield published two quarto volumes of his miscellaneous works, of which the most valuable part is the Memoirs of his Life and Writings.

GIBBONS, James, an American Roman Catholic prelate and cardinal, was born in Baltimore in 1834. He was ordained in 1861. In 1868 he was made Vicar Apostolic of North Carolina, and to fulfill the duties of the office he was consecrated bishop. His successful administration of this difficult work earned him promotion in 1872 to the See of Richmond, Va., and his five years there were also marked by notable development of the church's activity in many directions. In 1877 he was appointed coadjutor with right of succession to Archbishop Bailey of Baltimore then in failing health, and later in the same year succeeded to the dignity of Primate of the U. States, which is annexed to the See of Baltimore as the earliest in foundation. In recognition of the growing importance of the American branch of the church, he was created a cardinal by Leo XIII. in 1886. His best-known work is The Faith of Our Fathers (1871), an admirable popular exposition of the Roman Catholic doctrines; others are: Our Christian Heritage (1889) and The Ambassador of Christ (1896).

GIBEON, one of the ancient royal cities of the Canaanites, a "great city" of the Hivites, who at an early stage of Joshua's conquests, by disguising themselves in old clothes and professing to come from a far country, obtained an alliance and covenant with the Israelites. When the stratagem was discovered, the Israelites resolved to observe the covenant, but condemned them to be "hewers of wood and drawers of water unto all the congregation" (Jos. ix. 21). It was during the battle here between Joshua and the five kings of the Amorites that the sun "stood still upon Gibeon, and the moon in the valley of Ajalon." Gibeon has been identified with the modern El-Jib.

GIBRALTAR (jib-ral'târ), a town and strongly fortified rocky peninsula near the southern extremity of Spain, belonging to Great Britain. It is connected with the mainland by a low sandy isthmus, 1½ miles long and ¾ mile broad, known as the "neutral ground," and has Gibraltar Bay on the west, the open sea on the east and south. The highest point of the rock is about 1400 feet above sea-level; its north face is almost perpendicular, while its east side exhibits tremendous precipices. On its south side it is almost inaccessible, making approach from seaward impossible; the west side, again, although very rugged and precipitous, slopes toward the sea; and here the rock is secured by extensive and powerful batteries, rendering it apparently impregnable. Vast sums of money and an immense amount of labor have been spent in fortifying this celebrated stronghold, which, as a coaling station, depot for war material, and a port of refuge in case of war, would form one of the most important points of support for British naval operations and British commerce eastward. Numerous caverns and galleries, extending 2 to 3 miles in length, and of sufficient width for carriages, have been cut in the solid rock, with port-holes at intervals of every 12 yards bearing upon the neutral ground and the bay, and mounted with more than 1000 guns, some of them of the largest size. The garrison numbers about 5000. Every precaution is taken to prevent the immigration into the town of new residents. The civil population amounts to about 22,000.

GIBRALTAR, Straits of, the channel which forms an entrance from the Atlantic into the Mediterranean. The narrowest part is a little to the west of Gibraltar, and 8½ miles across. A strong and constant current flows into the Mediterranean from the Atlantic Ocean, in the middle of the Straits, but the under-current as well as two feeble lateral currents along the coast set toward the ocean.

GIBSON (gĭb'son), Charles Dana, American illustrator, was born at Roxbury, Mass., in 1867. His subjects are taken from the boulevards, byways, theaters, clubs, law courts, music halls, parks, and crowds in stations. His most popular works are society cartoons. His published works include: London, as Seen by C. D. Gibson; Pictures of People; People of Dickens; Sketches and Cartoons; The Education of Mr. Pipp; Americans; A Widow and Her Friends; The Social Ladder. He created the type of woman known as the "Gibson girl."

GIDDINGS, Joshua Reed, a prominent constitutional abolitionist in the anti-slavery struggle, was born in Pennsylvania in 1795. He served in the war of 1812, was elected to the state legislature in 1826, and was a member of congress from 1838 to 1859. He took a conspicuous part in the struggle to prevent the extension of slavery, to the territory wrested from Mexico by the war of 1846–7, and in resisting the adoption of the compromise of 1850, especially the enactment of the fugitive slave law, and in the struggle that made Kansas a free state. In 1861 he was appointed consul-general at Montreal. He died in 1864.

GIDEON (Hebrew, meaning a destroyer), the son of Joash, of the tribe of Manasseh, divinely called to deliver the Israelites from the oppression of the Midianites. Having effected their deliverance he was chosen judge of Israel. See Judges vi.–viii.

GILBERT, Sir John, R. A., English painter, born in 1817. He first exhibited in 1836. His first notable work was The Arrest of Lord Hastings by the Protector Richard, Duke of Gloucester, in water-color. He has also painted in oil, and among his more notable productions in that branch of the art are Don Quixote giving Advice to Sancho Panza, The Education of Gil Blas, and a series of tableaux of the principal characters in Shakespeare.

GILBERT, William Schwenk, English dramatist, born in London in 1836. In 1875 he entered into partnership with Arthur Sullivan the composer, and in conjunction with him produced a series of comic operas, Trial by Jury (1876), H. M. S. Pinafore (1878), The Pirates of Penzance (1880), Patience (1882), Iolanthe (1883), Princess Ida (1884), The Mikado (1885), The Yeomen of the Guard (1888), The Gondoliers (1889), Utopia, Limited (1893).

GILBERTINES, an order of monks founded in England by Gilbert of Sempringham in the 12th century.

GILBERT ISLANDS, or **KINGSMILL GROUP,** a group of sixteen islands in the Pacific Ocean, on the Equator, between lon. 172° 0′ and 174° 30′ e. under British protection; area 166 sq. miles. Pop. 35,000, some of them Christians.

GILDER, Richard Watson, American poet and editor, was born in Bordentown, N. J., in 1844. After some experience in editorial work, he founded the Newark Register, and later was editor of Hours at Home, and afterward assistant editor of Scribner's Monthly, into which the former was merged. In 1881 he succeeded Dr. Holland as editor-in-chief of the latter under its new name of the Century. He was one of the founders of the Society of American artists, of the Authors club, and of the International copyright league; also chairman of the New York tenement house commission of 1894. He was first president of the New York kindergarten association; vice-president and acting president of the city club of New York; president of the public art league of the U. States. He has published volumes of poems, as follows: The New Day; The Celestial Passion; Lyrics; Two Worlds; The Great Remembrance (these in one volume); Five Books of Song; In Palestine, and Other Poems; and Poems and Inscriptions.

GILDER, William Henry, American Arctic explorer, was born in Philadelphia, Pa., in 1838. In 1871–77 he was managing editor of the Newark Register, and in 1878–80 was second in command on the expedition of Lieutenant Schwatka in search of the relics of Sir John Franklin. He accompanied the De Long expedition on the Rodgers under Captain Berry, and after the burning of the vessel on the western shore of Bering Strait, made a midwinter journey of nearly 2000 miles across Siberia to telegraph to the government the news of the disaster. He afterward participated in the search for De Long in the Lena Delta. He died in 1900.

GILDING, is the art of applying gold-leaf or gold in a finely divided state to surfaces of wood, stone, or metals, a very ancient art, being practiced among the Egyptians, Greeks, Romans, and Ancient Persians. The processes employed at the present day are very varied. Metals are gilded either by what is called chemical gilding, mercurial gilding, by electro-gilding, or by the application of gold-leaf. Copper and brass, for instance, may be gilded by the process called wash or water gilding, with an amalgam of gold and mercury. The surface of the copper, freed from oxide, is covered with the amalgam, and afterward exposed to heat till the mercury is driven off, leaving a thin coat of gold. Gilding is also performed by dipping a linen rag in a saturated solution of gold and burning it to tinder, the black powder thus obtained being rubbed on the metal to be gilded, with a cork dipped in salt water, till the gilding ap-

pears. Iron or steel is often gilded by applying gold-leaf, after the surface has been well cleaned, and heated until it has acquired the blue color which at a certain temperature it assumes. Several leaves of gold are thus applied in succession, and the last is burnished down cold. Gilding on wood, plaster, leather, parchment, or paper, is performed by different processes of mechanical gilding. The first of these is oil-gilding, in which gold-leaf is cemented to the work by means of oil-size. In the case of paper or vellum the parts to be gilt receive a coat of gum-water or fine size, and the gold-leaf is applied before the parts are dry. They are afterward burnished with agate. Lettering and other gilding on bound books are applied without size. The gold-leaf is laid on the leather and imprinted with hot brass types. Brass rollers with thin edges are employed in the same way for lines, and similar tools for other ornaments. When the edges of the leaves of books are to be gilt they are first cut smooth in the press after which a solution of isinglass in spirits is laid on, and the gold-leaf is applied when the edges are in a proper state of dryness. Japanner's gilding is another kind of mechanical gilding, which is performed in the same way as oil-gilding except that instead of gold-leaf a gold dust or powder is employed. Frames of pictures and mirrors, mouldings, etc., are gilt by the application of gold-leaf, or by the cheaper process of "German gilding," that is, by tin-foil or silver-leaf, with a yellow varnish above. Porcelain and other kinds of earthenware, as well as glass, may be gilt by fixing a layer of gold in a powdered state by the action of fire. The gold-dust or powder required in this operation may be obtained by precipitating it from a solution in aqua regia, either by means of sulphate of iron or proto-nitrate of mercury. In order that the gold powder may be applied to the surface of the article to be gilded it must be well mixed with some viscous vehicle, such as strongly-gummed water. It is then laid on with a fine camel's-hair brush.

GIL'EAD, a mountain region on the east of Palestine, having Bashan on the north and Moab and Ammon on the south. It was noted for its balm, as well as for its pasturage.

GILL, a measure of capacity equal to $\frac{1}{4}$ of a pint, and $\frac{1}{32}$ of a gallon.

GILLETTE, William Hooker, American actor and playwright, was born at Hartford, Conn., in 1855. He has written a number of plays of great popularity, to the presenting of which he has devoted himself on the stage. Among them are The Private Secretary, Esmeralda, Held by the Enemy, Too Much Johnson, and Secret Service. His latest New York success was in his dramatization of Sir Conan Doyle's Sherlock Holmes.

GILLISS (gĭl'lĭs), James Melville, American astronomer, born in Georgetown, D. C., in 1811. He became in 1836 assistant in the bureau of charts and instruments in Washington, and two years later, in a small wooden building belonging to the navy department, organized the first working observatory in the U. States. He conducted at Washington astronomical observations of great value, which were published by the government in 1846, containing the first catalogue of stars, and being the first report of astronomical observations to be published in America. He became superintendent of the national observatory at Washington, a position which he held until his death. Under his control the observatory became one of the best equipped in the world. His publications include: Astronomical Observations Made at the Naval Observatory; The United States Astronomical Expedition to the Southern Hemisphere, 1849–52. He died in 1865.

GILLMORE (gĭl'môr), Quincy Adams, American soldier and military engineer, born at Black river, Lorain co., Ohio, in 1825. During the civil war he was one of the ablest military engineers in the federal service. He acted as chief engineer of the Port Royal expeditionary corps in 1861–62; was chief engineer at the siege of Fort Pulaski, Ga.; from February to April, 1862, was in command during the bombardment and capture of that fort; and on April 28, 1862, was raised to the rank of brigadier-general of volunteers. He then commanded successively the District of Western Virginia, the First Division of the Army of Kentucky, and the District of Central Kentucky, and on March 30, 1863, was brevetted colonel in the regular army. On March 13, 1865, he was brevetted brigadier-general in the regular army, and major-general in the regular army; and on December 5, 1865, he resigned from the volunteer service. After the close of the war he was in charge of various river and harbor improvements of importance. He was president of the Mississippi river commission from 1879 to 1882, was raised to the regular rank of colonel of engineers in February, 1883, and at various times was a member of important engineer boards. In 1876 he was one of the judges at the centennial exposition. He died in 1888.

GILLS, the respiratory organs of animals which respire by obtaining oxygen from water, as crustaceans, molluscs, fishes, and amphibians. In fishes they consist of cartilaginous or bony arches attached to the bones of the head, and furnished on the exterior convex side with a multitude of fleshy leaves or fringed vascular fibrels resembling plumes, and of a red color in a healthy state. The water is admitted by the gill-opening, and acts upon the blood as it circulates in the fibrils.

GILLYFLOWER (jĭl'i), a name bestowed on such cruciferous flowers as the wall-flower or carnation, etc. The clove-pink is termed clove gillyflower.

GILMAN, Daniel Coit, American educator, was born in Norwich, Conn., in 1831. In 1877 he was made president of the University of California, and in 1875 was called to the presidency of John Hopkins university of Baltimore, and retained this office for twenty-five years, when he was chosen president of the Carnegie institution at Washington. He was appointed by President Cleveland one of the commissioners to determine the true boundaries of Venezuela. His publications include magazine articles; an introduction to the Tocqueville Democracy in America; a Memoir of James Dwight Dana and President Monroe. He was the Editor-in-Chief of the New International Encyclopedia. He died in 1908.

GILMORE, Patrick Sarsfield, American military bandmaster, was born near Dublin, Ireland, in 1829. He came to the U. States in 1847 and settled in Salem, Mass., where he became conductor of a military band. The famous Gilmore's Band was organized by him at Boston, in 1859. During the war he established a brilliant musical record, and in 1864, at New Orleans, gave a magnificent musical festival. His performers were the combined bands of many regiments, which, together with such novel effects as the booming of cannon to emphasize more strongly the musical rhythm, combined to make the festival memorable. The National peace jubilee of 1869, and the World's peace jubilee of 1872, held on Boston common, gained him an international reputation. The entire musical ensemble in 1869 consisted of an orchestra of 1000, and a chorus of 10,000 voices, which number was doubled in the festival of 1872. This huge volume was still further reinforced by a powerful organ, artillery guns, bells, and other devices. He published several compositions and arrangements for military bands, but is of far greater importance as a conductor, and for the perfection to which he brought the concert military band organization. He died in 1892.

GIN, a spirit distilled from grain, and flavored with juniper-berries, and sometimes with oil of turpentine and common salt, and other substances. It is largely manufactured in Holland, particularly in Schiedam, and the gin thence imported is thus often called Schiedam as well as Hollands.

GIN, the name of certain machines employed in raising weights. One form consists of three poles, 12 to 15 feet long, often tapering from the lower extremity to the top and united at their upper extremities, when a block and tackle is suspended. A space of 8 or 9 feet separates the lower extremities planted in the ground, and a kind of windlass is attached to two of the legs. Another kind of gin is a sort of whim or windlass for raising coal, etc. It is worked by a horse, which turns a cylinder, and winds on it a rope, by which the weight is raised.

GINGER, an East Indian plant. It grows in moist places in various parts of tropical Asia and the Asiatic islands, and has been introduced into the West Indies, particularly Jamaica, as also into S. America and West Africa. The kind most esteemed is Jamaica ginger. The rhizome, or underground stem, is what is used, being employed in various ways. It has an aromatic, pungent taste, and when young is candied, and makes an excellent preserve. It is a favorite condiment, and is used medicinally as a carminative, and in debility of the stomach and alimentary canal. It is often useful in cases of toothache, relaxation of the uvala, and paralytic affections of the tongue. It enters into the composition of a great number of

confections, infusions, pills, etc. The special preparations are the tincture and the essence of ginger; syrup, prepared by mixing twenty-five parts of

Ginger plant.

syrup with one of the strong tincture. Infusion of ginger is a preparation useful for flatulence.

GINGER-ALE, an aërated water made in the same way as lemonade, but flavored with ginger instead of lemon.

GINGER-BEER, a pleasant, non-alcoholic, effervescing beverage, made by mixing together ginger, cream of tartar, sugar, yeast, and water and allowing the whole to ferment for a time, then bottling. Ginger-beer may also be prepared thus: Add to each gallon of water 1 lb. of refined sugar, and ½ oz. of ground ginger. Boil for an hour, add the white of two eggs, remove the scum. Strain into a vessel to cool, cask it up with the juice and peel of a lemon. Add a very small amount of brewer's yeast, and bung up tightly for a fortnight.

GINGER-BREAD, a well-known cake made in many ways, the chief ingredients being flour and treacle, with ginger butter, eggs, etc.

GINGER-CORDIAL, or **GINGER-WINE,** a beverage made from raisins, lemon rind, ginger, sugar, and water, with some whisky or brandy.

GINGHAM (ging'am), a cotton fabric distinguished from calico by having the colors woven with the fabric, not printed on it. The patterns are various; sometimes fancy designs, sometimes checkered and sometimes striped. Umbrella ginghams are all of one color.

GINSENG (jin'seng), a plant of Northern Asia, herbaceous, and about 1 foot high. Its root is regarded as a sort of

Ginseng.

panacea among the Chinese, and is largely imported, but it appears to be really of very little efficacy; the taste is sweet and mucilaginous, and also accompanied with some bitterness, and also slightly aromatic. Another species of ginseng inhabits Canada and the northeastern parts of the U. States. Quantities of its root are sent to China.

GIPSY. See Gypsies.

GIRAFFE, a ruminant animal inhabiting Africa, and constituting the only species of its genus and family. It is the tallest of all animals, a full-grown male reaching the height of 18 or 20 feet. This great stature is mainly due to the extraordinary length of the neck, in which, however, there are but seven vertebræ, though these are extremely elongated. It has two body excrescences on its head resembling horns. Its great height is admirably suited with its habit of feeding on the leaves of trees, and in this the animal is further aided by its tongue, which is both prehensile and capable of being remarkably elongated or contracted at will. When it browses the herbage on the ground it stretches

Giraffe.

out its fore-legs as wide as possible till it can reach the ground by means of its long neck. Its color is usually light fawn, marked with darker spots. It is a mild and inoffensive animal, and in captivity is very gentle and playful. The giraffe is a native of a great part of Africa, from Abyssinia and Sennaar to Senegal and the regions adjacent to the Cape Colony.

GIRARD COLLEGE, an institution in Philadelphia, Pa., founded by the bequest of about $8,000,000, left by Stephen Girard, for the benefit of poor white male orphans, who are admitted between the ages of six and ten, and, according to the will of the founder, are to be apprenticed to some industrial occupation when between the ages of fourteen and eighteen. The buildings are situated 2 miles n. w. of the old state-house, in a fine enclosure of 41 acres. The principal building (169 feet long, 111 feet wide, and 97 feet high, with fine Corinthian columns, each 55 feet high) is by far the best specimen of Greek architecture in the U. States. It is built mainly of white marble, with no inflammable material, as nearly as possible in accordance with the minute directions left by Mr. Girard, according to whose will no minister or ecclesiastic of any sect or church is allowed to visit the premises on any pretext or to have any connection with the institution. The construction of the buildings was begun in 1833, and finished in 1848. In 1900 the value of the residuary fund was $15,958,293 and the building accommodated about 2,000 boys.

GIRARD, Stephen, philanthropist, born near Bordeaux, France, May 24, 1750; became a sailor, and before the revolution in North America engaged as the master of vessels in the American coasting and West India trade; and during the revolution was a grocer, sutler, and liquor-seller in and near Philadelphia In 1812 he became a private banker, and was later a director of the second U. States bank. He was for years by far the wealthiest man in the U. States. He was very eccentric in his habits, a freethinker, ungracious in manner, ill-tempered, and lived and died without a friend; but was always a liberal benefactor of the public charities and even of churches, which he despised. During several yellow fever seasons in Philadelphia he was active in relieving distress by free expenditure of money and personal care of the sick; and at his death nearly all his estate was bequeathed to various charitable and municipal institutions of Philadelphia and New Orleans, and to the founding of the Girard college for orphan boys. He died in Philadelphia, Dec. 26, 1831.

GIRDER, a main beam, either of wood or iron, resting upon a wall or pier at each end, employed for supporting a superstructure, or a superincumbent weight, as a floor, the upper wall of a house when the lower part is sustained by pillars, the roadway of a bridge, and the like. Wooden girders are sometimes cut in two longitudinally and an iron plate inserted between the pieces, and the whole bolted together. This species of girder is called a sandwich-girder. For bridges cast-iron girders are sometimes cast in lengths of 40 feet and upward, but when the span to be crossed is much greater than 40 feet, recourse is had to wrought-iron, or to trussed, latticc, or box girders, and cast-iron is now little used. A trussed-girder is a wooden girder strengthened with iron. A lattice-girder is a girder consisting of two horizontal beams united by diagonal crossing bars, somewhat resembling wooden lattice-work. A box-girder is a kind of girder resembling a large box, such as those employed in tubular bridges. There are also bowstring-girders, which are varieties of the lattice-girder, and consist of an arched beam, a horizontal tie resisting tension and holding together the ends of the arched rib, a series of vertical suspending bars by which the platform is hung from the arched rib, and a series of diagonal braces between the suspending bars.

GIRDLE OF VENUS, an animal belonging to the Ctenophora, found in the Mediterranean. In shape it resembles a ribbon, and it is apparently propelled by the cilia which fringe its edge. The mouth is situated on the inferior edge. It is iridescent by day, and brilliantly phosphorescent at night.

GIRGEH (jir'je), town, formerly capital, of Upper Egypt, on the left bank of the Nile. It possesses a Roman Catholic convent, the oldest in Egypt. Pop. 10,000.

GIRGENTI (jir-jen'tē), a town in the southwest of Sicily, capital of the prov-

ince of same name. The province has an area of 1490 sq. miles, and is rather mountainous in character. Pop. 371,471.

GIRONDE (zhē-rōnd), a department of France, on the Bay of Biscay, named from the Gironde estuary; area, 3610 sq. miles. Bordeaux is the capital. Pop. 820,781.

GIRONDE, River. See Garonne.

GIRONDISTS (Girondins), one of the great political parties of the first French revolution. The Girondists were republicans, but were more distinguished for visionary ideals than for a well-defined policy; hence they fell an easy prey to the party of the Mountain. Their leaders were three of the deputies of the Gironde—Verginaud, Guadet, and Gensonné, hence the name. Louis XVI. was obliged, in 1792, to select a ministry from among the Girondists, but it was short-lived. In the convention their struggles with the Montagnards forced them into extreme measures which they would otherwise have avoided. They wished to save the king, but many of them, from a mistaken policy, voted for his death. Their fall dates from their unsuccessful impeachment of Marat (1793), soon after which a large number of them were proscribed, and twenty-one of them were condemned and executed.

GIRTY (ger'ti) Simon, renegade leader of the Indians, was born in Pennsylvania in 1741, was captured by the Indians, along with the rest of his family at Fort Granville, in 1756; was released in 1759, and acted as an interpreter for some time after the conspiracy of Pontiac. In Lord Dunmore's war he served against the Indians, and for a short time thereafter was a second lieutenant in the Virginia militia. In 1776 he was appointed an Indian interpreter for the U. States, but was soon discharged, after which he enlisted troops in the vicinity of Fort Pitt for service against the English. He went over to the English in April, 1776, was attainted of high treason by the Pennsylvania legislature in July, and became an interpreter in the employ of the British Indian department. He commanded the Indians who attacked Dunlap's Station, on the Great Miami, in February, 1791; led the Wyandots at the defeat of Saint Clair; commanded the Indians who attacked Fort Jefferson, on the Mississippi, in June, 1791; and in 1794 participated in the battle of Fallen Timbers. He died in 1818.

GIULIO ROMANO (jō'lē-ō rō-mä'nō), or **GULIIO PIPPI,** Italian painter, architect, and engineer, the most distinguished of Raphael's scholars, born at Rome near the end of the 15th century. After the death of Raphael he gave himself up to his own imagination, and astonished all by the boldness of his style, by the grandeur of his designs, by the fire of his composition, by the loftiness of his poetical ideas, and his powerful expression.

GIZZARD, a strong muscular part of the alimentary canal of birds, which enables them to grind their food. A gizzard occurs also in many gasteropods, and in certain cephalopods and crustaceans. In birds it is lined by a thick muscular coat, and usually contains pieces of gravel, etc., to facilitate the grinding process.

GLACIAL PERIOD, or **ICE AGE,** in geology, denotes that portion of the post-tertiary period, in which Britain, Europe, and, in short, all parts of the Old and the New World north of latitude 50°–40° were subjected to intense cold, and covered with ice and glaciers. This phenomenon has been demonstrated from a study of the actual effects of glaciers in the Alps, etc. The traces of ancient glacial action are abundantly discoverable in the Highlands of Scotland, in England, in the Scandinavian range, the Jura, the Black Forest, etc. In Asia they are perceptible in the Himalaya, while North America abounds with them. See Geology.

GLACIERS, icy masses of great bulk, harder than snow, yet not exactly like common ice, which cover the summits and sides of mountains above the snow-line. They are found in Switzerland, Scandinavia, the Andes, etc. They extend down into the valleys often far

Glacier of Zermatt, Switzerland.

below the snow-line, and bear a considerable resemblance to a frozen torrent. They take their origin in the higher valleys, where they are formed by the congelation and compression of masses of snow in that condition called by French writers névé, by German authors firn. The ice of glaciers differs from that produced by the freezing of still water, and is composed of thin layers filled with air-bubbles. It is likewise more brittle and less transparent. The glaciers are continually moving downward, and not unfrequently reach the borders of cultivation. The rate at which a glacier moves generally varies from 18 to 24 inches in twenty-four hours. At its lower end it is generally very steep and inaccessible. In its middle course it resembles a frozen stream with an undulating surface, broken up by fissures or crevasses. As it descends it experiences a gradual diminution from the action of the sun and rain, and from the heat of the earth. Hence a phenomenon universally attendant on glaciers—the issue of a stream of ice-cold turbid water from their lower extremity. The descent of glaciers is shown by changes in the position of masses of rock at their sides and on their surface. A remarkable glacier phenomenon is that of moraines, as they are called, consisting of accumulations of stones and detritus piled up on the sides of the glacier, or scattered along the surface. They are composed of fragments of rocks detached by the action of frost and other causes. The fissures or crevasses by which glaciers are traversed are sometimes more than 100 feet in depth, and from being often covered with snow are exceedingly dangerous to travelers. One of the most famous glaciers of the Alps is the Mer de Glace, belonging to Mont Blanc, in the valley of Chamouni, about 5700 feet above the level of the sea. It is more especially, however, in the chain of Monte Rosa that the phenomena of glaciers are exhibited in their greatest sublimity, as also in their most interesting phases from a scientific point of view. Glaciers exist in all zones in which mountains rise above the snow-line. Those of Norway are well known, and they abound in Iceland and Spitzbergen. Hooker and other travelers have given accounts of those of the Himalaya. They are conspicuous on the Andes, while the Southern Alps of New Zealand rival in this respect the Alpine regions of Switzerland.

The problem of the descent of the glaciers is of extraordinary interest, and various theories have been put forward to account for it. It was shown by Professor J. D. Forbes, of Edinburgh, that a glacier moves very much like a river; the middle and upper parts faster than the sides and the bottom; and he showed that glacier motion was analogous to the way in which a mass of thick mortar or a quantity of pitch flows down in an inclined trough. His theory is known as the viscious theory of glaciers, which presupposes that ice is a plastic body, and this plasticity has been satisfactorily explained by Professor James Thomson of Glasgow by the phenomenon of the melting and refreezing of ice. Water, he discovered, when subjected to pressure, freezes at a lower temperature than when the pressure is removed. Consequently when ice is subjected to pressure it melts; if it is relieved of pressure the water again solidifies. Therefore if two pieces of ice are pressed together, they tend to relieve themselves by melting at their points of contact, and the water thus produced immediately solidifies on its escape. If ice is strained in any way it similarly relieves itself at the strained parts, and a similar regelation follows. This, when applied to the glaciers, gives a complete explanation of their plasticity. Pressed downward by the vast superincumbent mass, the ice gradually yields. Melting and refreezing takes place at some parts, at others the gradual yielding at strained points goes on. In the latter process there is no visible melting but there is the gradual yielding from point to point to the pressure above and there is the transference relatively to each other of the molecules that constitute the, at first sight, solid mass. If however, at certain points the strain is intense, the ice becomes extremely brittle. The latter fact disposes of Tyndall's objection to Forbes' theory, which was based on the fact that crevasses proved the brittleness, and not the viscosity of ice.

GLACIER TABLES, large stones found on glaciers supported on pedestals of ice. The stones attain this peculiar position

by the melting away of the ice around them, and the depression of its general surface by the action of the sun and rain. The block, like an umbrella, protects the ice below it from both; and accordingly its elevation measures the level of the glacier at a former period. By and by the stone table becomes too heavy for the column of ice on which it rests, or its equilibrium becomes unstable, whereupon it topples over, and falling on the surface of the glacier defends a new space of ice, and begins to mount afresh.

GLADBACH (Mönchen-), a town of Prussia, province of Rheinland, 16 miles west of Düsseldorf, with extensive manufactures of cotton and mixed cotton goods, etc. Pop. 58,023.

GLADIA'TORS, combatants who fought at the public games in Rome for the entertainment of the spectators. The first instance known of gladiators being exhibited was in B.C. 264, by Marcus and Decimus Brutus at the funeral of their father. They were at first prisoners, slaves, or condemned criminals; but afterward freemen fought in the arena, either for hire or from choice; and latterly men of senatorial rank, and even women, fought. The regular gladiators were instructed in schools (ludi), and the overseer (lanista) purchased the gladiators and maintained them. Men of position sometimes kept gladiatorial schools and lanistæ of their own. The gladiators fought in the schools with wooden swords. In the public exhibitions, if a vanquished gladiator was not killed in the combat, his fate was decided by the people. If they wished his death, perhaps because he had not shown sufficient skill or bravery, they held up their thumbs; the opposite motion was the signal to save him. The victor received a branch of palm or a garland. The gladiators were classified according to their arms and mode of fighting; thus there were retiarii who carried a trident and a net (L. rete) in which they tried to entangle their opponent; Thracians, who were armed with the round Thracian buckler and a short sword; secutores, who were pitted against the retiarii; etc.

GLADSTONE, Right Hon. William Ewart, a great British statesman, was born at Liverpool in 1809, and died at Hawarden in 1898. In 1832 the first reform act was passed, and Mr. Gladstone's public career commenced by his being returned for Newark, and when Peel assumed office in 1834 he accepted the post of junior lord of the treasury. He took part with Peel in the repeal of the corn-laws, a course which cost him his seat for Newark. In 1847 he was returned for Oxford university, and he then supported the bill for the removal of Jewish disabilities, the repeal of the navigation laws, etc. He now began to develop remarkable ability as a financier and fiercely attacked Mr. Disraeli's budget of 1852. The same year he became chancellor of the exchequer under the Earl of Aberdeen, a post which he also held for a short time in 1855 under Lord Palmerston. In 1858 he became high commissioner extraordinary to the Ionian Islands, and his Studies on Homer appeared about the same time. In 1859 he again took office as chancellor of the exchequer under Lord Palmerston. At the general election of 1865 Mr. Gladstone was returned for South Lancashire, and on the decease of Lord Palmerston he became the liberal leader in the commons in the Russell administration, still continuing to hold the chancellorship of the exchequer. The government, being defeated on the reform question, went out in 1866, and Lord Derby came into power. Parliament was dissolved in 1874, and the conservatives ousted Mr. Gladstone from office, as they had secured a good majority. During Lord Beaconsfield's

Right Hon. W. E. Gladstone.

tenure of office Mr. Gladstone denounced the Bulgarian atrocities, the Anglo-Turkish treaty, and the Afghan war, and his speeches during his candidature for Midlothian greatly helped to render the government unpopular. In 1880 the general election reinstated Mr. Gladstone firmly into power (Midlothian being now his constituency), and his second Irish land bill became law in the following year. In 1882 a prevention of crimes and an arrears act for Ireland were passed, and in 1883 measures relating to bankruptcy, etc., were also carried. In 1884 the bill extending household suffrage to the counties was carried, and the Gladstone ministry fell the next year. Lord Salisbury, who had formed an administration, got the redistribution of seats bill passed, and under it took place the general election of 1885, Mr. Gladstone still continuing to represent Midlothian. Next year Lord Salisbury resigned after an adverse vote in the commons, and Mr. Gladstone again came into power. He now introduced a home rule bill for Ireland (April 8, 1886). It failed to pass the commons, and the result of the general election which followed was emphatically adverse to Mr. Gladstone's proposals. He had to make way for Lord Salisbury, but in 1892 he again became premier. After passing a home rule bill through the commons he resigned office in 1894, and next year retired from political life. His works include The State in its Relations with the Church (1838); Studies on Homer and the Homeric Age; Juventus Mundi; Homeric Synchronism; Landmarks of Homeric Study; The Impregnable Rock of Holy Scripture, etc.

GLAMOR'GAN, or **GLAMORGANSHIRE,** a county in South Wales; area, 547,070 acres. The north and northeast parts of the county are extremely mountainous, and often exhibit scenes of the most romantic beauty. The southern portion is comparatively level and very fertile, particularly the vale of Glamorgan. Towns: Cardiff, the capital; Merthyr-Tydfil, Swansea, and Neath. Pop. 860,022.

GLANDERS, one of the most formidable diseases to which horses are subject, indicated by a discharge of purulent matter from one or both nostrils, with a hard enlargement of the submaxilliary glands. In acute glanders the discharge, by its copiousness, impedes respiration and ultimately produces suffocation. The disease is highly infectious, and may even be communicated to man by the purulent matter coming in contact with any part where the skin is broken. The disease is rarely if ever cured.

GLANDS, a certain class of structures in animals, some of them forming organs which are the seat of an excretion, and provided with an excretory canal. In man there are two lachrymal glands, situated at the external angle of the eyes under the upper eyelid; six salivary, of which three are on each side, behind and under the lower jaw; two parotid, two submaxillary, two sublingual, two mammary, confined to the female (the breasts in women); the liver, the pancreas, the two kidneys, etc. The lymphatic glands, which take up and elaborate the lymph, are somewhat different from these in character; and still more different are certain other bodies so denominated, as the spleen, thymus, pineal, etc. Botanists have given the name of glands to small bodies observed upon the surfaces of plants, and many of which seem to secrete certain fluids.

GLAS'GOW, the largest city in Scotland, and the second largest in the United Kingdom, is situated mainly in the county of Lanark (but is now a

The Trongate, Glasgow.

county of itself), on both banks of the Clyde, the largest and more important part of it on the right or north bank. The southern portion is mainly built

on low-lying level ground, the northern portion to a great extent on a series of elevations of varying heights. The river is crossed by ten bridges (including railway bridges), as also by ferries; and there are also tunnels under it. Glasgow has several large and attractive public parks. There are also botanic gardens with extensive hot-houses. There is a public museum, and a collection of pictures belonging to the city, containing a number of very valuable works especially of the Venetian school. The principal libraries are the University Library, the Mitchell Free Library, the libraries of the Faculty of Medicine and of the Faculty of Procurators, and the combined Glasgow and Stirling's Libraries. Among educational institutions after the university are Anderson's College Medical School, St. Mungo's College, the Glasgow and West of Scotland Technical College, the U. F. Church College, Queen Margaret College for Women, the normal institutions of the Established and United Free Churches, the Glasgow School of Art, the Veterinary College, the High School, under the management of the school board, and the Glasgow Academy. The industries are unequaled for variety by any town in the kingdom, with the exception, perhaps, of London. They embrace cotton, linen, woolen, silk and jute, in all the processes of manufacture; calico-printing, dyeing, and bleaching; pig and malleable iron and steel, and machinery and metal goods of all descriptions; shipbuilding, which might almost be called a staple, over 400,000 tons of shipping having been launched in some years on the Clyde; extensive chemical works, potteries, glass-works, brick-works, breweries, distilleries, tanneries, tobacco-works, sugar-refining works, etc. The commerce is commensurate in extent with the manufactures. The river itself, the chief highway of this commerce, has been made navigable for large vessels up to the heart of the city, and the harbor accommodations is still being extended by the construction of docks, quays, etc. In a sanitary point of view Glasgow has greatly improved in recent times, but it still remains less healthy than it might be; and its atmosphere is polluted with smoke, soot, and vapors from the public works, and its river with sewage. There is, however, a great difference between the sanitary conditions of different districts. The city is excellently supplied with water from Loch Katrine, a distance of about 30 miles. The works are capable of supplying 60,000,000 gallons daily. Pop. in 1901, 761,709.

GLASGOW UNIVERSITY, was founded by a bull of Pope Nicholas V., 1450–51, which conferred not only the power of creating masters and doctors, but privileges and immunities identical with those of the University of Bologna. In 1577 James VI. prescribed rules for the government of the university, giving it a new charter. It has been reconstituted by the Scottish universities acts of 1858 and 1889, and its constitution is similar to that of the others. The old university buildings and ground were sold to the Glasgow Union railway co. in 1864 for $500,000, a sum which, supplemented by university funds, government grant, public subscriptions and donations, has enabled upward of $3,000,000 to be expended on fine new buildings in the west end of Glasgow. The university comprises five faculties, viz., art, science, divinity, law, and medicine, each of which embraces a suitable equipment of chairs and professors, the latter numbering 31 in all, besides a number of lecturers. With it is incorporated Queen Margaret College for women. The university library numbers about 175,000 volumes.

GLASS, an artificial substance, hard, brittle, and in its finest qualities quite transparent, formed by the fusion of silicious matters with an alkali. Of the origin of its manufacture nothing is known, but the ancient Egyptians carried the art to great perfection, and are known to have practiced it as early as 2000 B.C., if not earlier. The Assyrians, the Phœnicians, the Greeks and Etruscans were all acquainted with the manufacture. The Romans attained peculiar excellence in glass-making, and among them it was applied to a great variety of purposes. Among the most beautiful specimens of their art are the vases adorned with engraved figures in relief; they were sometimes transparent, sometimes of different colors on a dark ground and very delicately executed. The Portland or Barberini vase is almost the only surviving specimen of this kind. The mode of preparing glass was known long before it was thought of making windows of it. The first mention of this mode of using glass is to be found in Lactantius, in the 3rd century after Christ. St. Jerome also speaks of it being so used (422 A.D.). Benedict Biscop introduced glass windows into Britain in A.D. 674. In church windows it was used from the 3d century. The Venetians were long celebrated for their glass manufacture, which was established before 700 A.D. Britain did not become distinguished for glass until about the commencement of the 16th century. Glass is largely made in France, Germany, Belgium, and the United States. For colored glass Bohemia has long had a high reputation.

Glass is formed by the fusion of silicious matter, such as powdered flint or fine sand, together with some alkali, alkaline earth, salt, or metallic oxide. The nature of the glass will depend upon the quality and proportion of the ingredients of which it is formed; and thus an infinite variety of kinds of glass may be made, but in commerce five kinds are usually recognized : 1. Bottle or coarse green glass. 2. Broad, spread, or sheet window-glass. 3. Crown-glass, or the best window-glass. 4. Plate-glass, or glass of pure soda. 5. Flint-glass, or glass of lead. Colored glass may be mentioned as a sixth kind. The physical properties of glass are of the highest importance. Perhaps the chief of these is its transparency, and next to that its resistance to acids (except hydrofluoric). It preserves its transparency in a considerable heat, and its expansibility is less than that of any other known solid. Its great ductility, when heated is also a remarkable property. It can, in this state, be drawn into all shapes, and even be spun into the finest threads. It is a bad conductor of heat, and is very brittle. It is usually cut by the diamond.

The works in which glass is made are called glass-houses. They are commonly constructed of brick, and made of conical form. A large vault is made in the interior of the cone, extending from side to side, and of sufficient height to allow workmen to wheel in and out rubbish from beneath the furnace, which is placed over the vault, and separated from it by an iron grating. The materials used for the formation of the glass are sometimes calcined in a calcar or fritting furnace, and a chemical union between the ingredients commenced, forming a frit. But this process is not essential,and the materials, after being ground and thoroughly mixed up together, are now usually placed at once in melting pots or crucibles made of Stourbridge fire-clay, or other similar material, the melting-pots being then placed in the melting furnace or oven. This is a kind of reverberatory furnace, is often circular in form, arched or domed above, and capable of keeping up an intense heat. The crucibles are placed in the furnace at equal distances from each other round the circumference, each pot being opposite to an opening in the wall of the furnace in order that the crucible may be charged or discharged by the workman from without. In recent times a furnace called a tank furnace has come into use and enables melting pots to be dispensed with, as the material can be—melted in and worked from the furnace directly. The use of the annealing furnace, is also essential in glass-making, the process of allowing the glass to cool there being called annealing. Unless this process be carefully managed, the articles formed in the glass-house can be of no use, from their liability to break by the slightest scratch or change of temperature.

GLASS-PAINTING, the art of producing pictures upon glass with colors that are burned in, or by the use of pieces of colored glass, in which the color forms part of the composition of the glass itself. Originally there was but one method of making ornamental glass windows, which was by the latter process: the pieces of stained or colored glass were cut to the desired shape, and let into the grooves of finely-made leaden frames which formed the pattern in outline, so that the pictures resembled mosaic work. In the 16th century, the enamel colors having been discovered, a new process came into vogue, the designs being now painted on the glass and burned in. At the present day the two methods, or a combination of the two, are chiefly employed, the mosaic-enamel method being the most common, and consisting of a combination of these two. The chief seats of the art in Britain are Birmingham and Edinburgh; in France, Paris and Sèvres; and in Germany, Munich and Nürnberg.

GLASS PAPER, or CLOTH, is made by strewing finely pounded glass on a sheet of paper or cloth which has been besmeared with a coat of thin glue, the glue being still wet. It is much used for polishing metal and wood-work.

GLAUBER, John Rudolph, a German chemist, born in 1603 or 1604. He is chiefly remembered for his discovery of sulphate of soda or Glauber's Salt, which he termed sal mirable, in consequence of his great faith in its medicinal qualities.

GLAUBER'S SALT, sulphate of sodium, so called because of the importance attached to its chemical and medicinal properties by Glauber. It forms large colorless monoclinic prisms, which effloresce on exposure to the air. It is soluble in water, and when heated melts in its water of crystallization. It is found in many localities, both dissolved in the water of mineral-springs and of salt lakes, round which it effloresces.

GLAUCO'MA, in med. an almost incurable disease of the eye, in which the eyeball becomes of stony hardness by the accumulation of fluid within, and the consequent increase of pressure causes disorganization of all the tissues. Loss of sight is sometimes very rapid. Called also Glaucosis.

GLAZING, is the covering of earthenware vessels with a vitreous coating in order to prevent their being penetrated by fluids. The materials of common glass would afford the most perfect glazing were it not that a glazing of this sort is liable to cracks when exposed to changes of temperature. A mixture of equal parts of oxide of lead and ground flint is found to be a durable glaze for the common cream-colored ware, and is generally used for that purpose. See Pottery.

GLEE, in music, a composition in three or more parts, generally consisting of more than one movement, the subject of which may vary greatly, from grave to gay, etc. Instrumental accompaniment is illegitimate.

GLEIWITZ (glī'vits), a town, Prussia, province of Silesia, on the Klodnitz. It has an extensive government iron-works, foundries, machine-works, glass-works, worsted and other mills, etc. Pop. 52,362.

GLENS FALLS, The, Warren co., N. Y., on the Hudson river, between Saratoga Springs and Lake George, and on the Delaware and Hudson canal company's railroad; 50 miles n. of Albany. Pop. 15,109.

GLOBE, a sphere, a round solid body, which may be conceived to be generated by the revolution of a semicircle about its diameter. An artificial globe, in geography and astronomy, is a globe of metal, plaster, paper, pasteboard, etc., on the surface of which is drawn a map, or representation of either the earth or the heavens, with the several circles which are conceived upon them, the former being called the terrestrial globe and the latter the celestial globe. In the terrestrial globe the wire on which it turns represents the earth's axis, the extremities of it representing the poles. The brazen meridian is a vertical circle in which the artificial globe turns, divided into 360 degrees, each degree being divided into minutes and seconds. The brass meridian receives the ends of the axis on which the globe revolves. At right angles to this, and consequently horizontal, is a broad ring of wood or brass representing the horizon; that is, the true horizon of the earth which lies in a plane containing the earth's center. The horizon and brass meridian are connected with the stand on which the whole is supported. On the surface of the globe, as on other maps, are marked

The globe.

parallels of latitude, meridians, etc. On a globe of some size the meridians are drawn through every 15° of the equator, each answering to an hour's difference of time between two places. Hence they are called the hour circles. A number of problems or questions, many of them more curious than useful, may be solved by means of a terrestrial globe. Among the most important are such as to find the latitude and longitude of a place, the difference of time between two places, the time of the sun's rising and setting for a given day at a given place, etc.

GLOBE-FISH, the name given to several fishes remarkable for possessing the power of suddenly assuming a globular form by swallowing air or water, which, passing into a ventral sac, inflates the whole animal like a balloon.

Pennant's globe-fish.

GLOB'ULIN, a substance forming a considerable proportion of the blood globules, and also occurring, mixed with albumen, in the cells of the crystalline lens of the eye. It resembles albumen.

GLORIA IN EXCELSIS DEO, "glory to God in the highest," the initial words (sung by the angels when the birth of Christ was announced to the shepherds) of a short Latin hymn known as the greater doxology, and used in the service of many Christian churches.

GLORIA PATRI, "glory be to the Father," the initial words of a short formula or hymn of praise to the Trinity known as the lesser doxology.

GLORIO'SA, a genus of tuberous-rooted climbing herbs of the nat. order Liliaceæ, so named from the splendid appearance of its flowers. They have branched stems and flowers mostly of a beautiful red and yellow color, with six long lanceolate undulated segments, which are entirely reflexed.

GLOS'SARY, a limited or partial dictionary, a vocabulary of words used by any author, especially in an old author, or one writing in a provincial dialect or of words occurring in a special class of works, of the technical terms of any art or science, of a dialect, and the like.

GLOTTIS, the opening at the upper part of the trachea or windpipe, and between the vocal chords, which, by its dilatation and contraction, contributes to the modification of the voice.

GLOUCESTER (glōs'tẽr), a city, county of itself, parliamentary borough, and river port, England, capital of the county of same name, on the left bank of the Severn, here divided into two channels inclosing the Isle of Alney and crossed by two fine bridges, 33 miles north by east of Bristol, and 95 miles west by north of London. It carries on a considerable shipping trade, the Gloucester and Berkeley canal giving access to the docks. Pop. 47,943. The county is bounded by the Severn, Monmouth, Hereford, Worcester, Warwick, Oxford, Berks, Wilts, and Somerset; area, 804,977 acres, of which five-sixths are under crops and pasture. Pop. 634,666.

GLOUCESTER, a town and port of Essex co., Mass., near the extremity of Cape Ann, 28 miles n.n.e. of Boston. It is a popular summer resort; and fisheries and granite quarrying are the chief industries. About two miles distant is Norman's Woe, the scene of the wreck of the "Hesperus" celebrated by Longfellow. Pop. 31,430.

GLOVERSVILLE, a town in Fulton co., New York, 44 miles n.w. of Albany. Glove-making is the principal business, hence the name of the place. Pop. 21,615

GLOVES, coverings for the hand, or for the hand and wrist, with a separate sheath for each finger. They are made of leather, fur, cloth, silk, linen, thread, cotton, worsted, etc. The chief leathers used in glove manufacture are doe, buck, and calf-skins; sheep-skin for military gloves; lamb-skin for much of the so-called kid gloves; true kid for the best and finest gloves; dog, rat, and kangaroo skins, etc. The leather in all cases undergoes a much lighter dressing than when used for boots and shoes. Leather gloves are usually cut out by means of dies, and sewed by a machine of peculiar construction. The best woolen, thread, and silk gloves are made by cutting and sewing, but commoner gloves are made by knitting and weaving. Gloves are a very ancient article of dress, and many curious customs and usages are connected with them. Throwing the glove down before a person amounted to a challenge to single combat. The judges in England used to be prohibited wearing gloves on the bench; and it was only in case of a maiden assize that the sheriffs were allowed to present a judge with a pair of gloves.

GLOW-WORM, an insect, the name being strictly applicable only to the female, which is without wings, somewhat resembles a caterpillar, and emits a shining green light from the extremity of the abdomen. The male is winged, and flies about in the evening, when it is

attracted by the light of the female, out gives out no light itself. It would seem that the glow-worm possesses the power of moderating or increasing the light at will. Decapitated specimens retain their

Glow-worm.

1, Male. 2, Female, upper side. 3, Female, under side, showing the three posterior segments (*a*) from which the light proceeds.

power of giving out light for a considerable time. In pure oxygen, warm water, or when crushed, the light of the luminous organs is increased in intensity. The larvæ are very voracious, living on snails, which they attack and kill.

GLOXIN'IA, a genus of plants, distinguished by the corolla approaching to bell-shaped, the upper lip shortest and

Gloxinias.

two-lobed, the lower three-lobed, with the middle lobe largest, and also by the summit of the style being rounded and hollowed. The species are natives of tropical America,.

GLUCK (gluk), Christoph Wilibald, Ritter von, German musical composer, born in Bavaria in 1714; died at Vienna 1787. In 1740 he was employed to compose an opera for the court theater of Milan. The text chosen for him was the Artaxerxes of Metastasio, and the opera was a triumph, in spite of the innovations of style which the author introduced. In 1742 he wrote Demofoonte for Milan; Demetrio and Ipermnestra for Venice; in 1743 Artamene for Cremona, and Siface for Milan; in 1744 Fedra for the same theater; and in 1745 Allessandro nell' Indie for Turin, all founded on classical subjects. Invited to London, he produced La Caduta de Giganti (Fall of the Giants), which was not a success. In London Gluck became deeply impressed with the majestic character of Handel's airs and choruses. The Trionfo di Clelia (1762) was the last of his operas in his first style. The composer found a poet in the person of Raniero Calzabigi, who sympathized with him in his ideas, and the result of their co-operation was the Orfeo ed Euridice, performed publicly for the first time in 1762. This opera marked a new era. The fame it acquired at once it never lost. Various works of lighter character filled up the interval between this year and 1766, when his second great opera of Alceste was produced, which raised public feeling to the point of enthusiam. A Frenchman of culture and genius, Bailly du Rollet, adapted Racine's Iphigénic en Aulide for musical treatment, and after a considerable amount of opposition from the musical critics of the old Italian and French school, at that time represented in Paris by Paccini, the piece was brought out in 1774. The intensest excitement prevailed; all Paris took sides, and for a long time the Gluckists and Piccinists contended with much bitterness, but ultimately the victory remained with the Gluckists. Shortly after the production of the Iphigénic, the Orfeo was adapted for and put on the French stage, and was followed by the Armide in 1777, by the Iphigénie en Tauride in 1779, Gluck's last important work, and by many considered his greatest. It ends the series of works which gave a direction to the operatic genius of Méhul and Cherubini in France, and of Mozart and Beethoven in Germany.

GLU'COSE, a variety of sugar, less sweet than cane-sugar, existing in grapes, and produced from cane-sugar, starch, dextrin, cellulose, etc., by the action of acids, certain ferments, and other reagents. There are two varieties of it, distinguished by their action on polarized light, viz. dextro-glucose which turns the plane of polarization to the right and lævo-glucose, which turns it to the left. When heated up to 400° it becomes caramel, and is used by cooks and confectioners as a coloring matter. It is called also grape-sugar and starch-sugar, and is produced both in the solid and in the liquid form, its manufacture being now of considerable importance. In the United States the liquid sugar, as prepared from Indian corn starch, is what is generally known as glucose, and it is used for various purposes, as for confectionery, canning fruits, making artificial honey, for table syrup, in brewing, etc.

GLU'COSIDES, a large class of substances occurring in animal or vegetable products, possessing the common property of yielding glucose and other products when they are boiled with dilute acids, or are acted on by certain ferments.

GLUE, a gelatinous substance obtained from different tissues of animals, and used as a cement for uniting pieces of wood or other material. The best quality is obtained from fresh bones, freed from fat by previous boiling, the clippings and parings of ox-hides, the older skins being preferred; but large quantities are also got from the skins of sheep, calves, cows, hares, dogs, cats, etc., from the refuse of tanneries and tawing works, from old gloves, from sinews, tendons, and other offal of animal origin. By a process of cleaning and boiling the albuminoid elements of the animal matter are changed into gelatine. This in a soft jelly-like state constitutes size; dried into hard, brittle, glassy cakes, which before use must be melted in hot water, it forms the well-known glue of the joiner, etc. When a solution is mixed with acetic or nitric acid it remains liquid, but still retains its power of cementing; in this state it is called liquid glue. Marine glue is a cement made by dissolving india-rubber in oil of turpentine or coal-naptha, to which an equal quantity of shellac is added.

GLUTEN, a tough elastic substance of a grayish color, which becomes brown and brittle by drying, found in the flour of wheat and other grain. It contributes much to the nutritive quality of flour, and gives tenacity to its paste. A similar substance is found in the juices of certain plants.

GLUTTON, a carnivorous quadruped, about the size of a large badger, and intermediate between the bear family and the weasels, resembling the former family in general structure and the latter in dentition. It inhabits Northern Europe and America, and is known also by the name of wolverene or wolverine.

GLYCERINE, a transparent colorless liquid, obtained from the by-products of candle and soap factories by saponification with alkalies or by the action of superheated steam. It sometimes solidifies at a low temperature to a crystalline mass. It absorbs moisture from the air, and dissolves in or mixes with water and alcohol in all proportions, but is insoluble in ether. It is the starting-point of certain valuable chemical products, one of the chief of which is nitro-glycerine.

GLY'CON, an Athenian sculptor known by his colossal marble statue of Hercules, commonly called the "Farnese Hercules," now in the museum at Naples. He probably lived in the 1st century B.C.

GLYP'TODON, a gigantic fossil edentate animal, closely allied to the armadilloes, found in the upper tertiary

Glyptodon.

strata of South America. It was of the size of an ox, and was protected by a coat of mail formed of polygonal osseous plates united by sutures.

GNAT, the name applied to several species of insects. The common gnat is of wide geographical distribution, and is noted for its power of inflicting irritating wounds. The female deposits her eggs on the surface of stagnant water in a long mass. After having remained in the larva state for about twenty days, they are transformed into chrysalids, in which all the limbs of the perfect insect are distinguishable, through the diaphanous robe with which they are then shrouded. After remaining three or four days wrapped up in this manner, they become perfect insects. The troublesome mosquito belongs to the same genus.

GNEISS (nīs), a species of rock, composed of quartz, felspar, and mica, arranged in layers. The layers, whether straight or curved, are frequently thick, but often vary considerably in the same specimen. Gneiss passes on one side into granite, from which it differs in its foliated structure, and on the other into mica slate. It is rich in metallic ores,

gold, silver, cobalt, antimony, copper, iron, etc., occurring in this rock, but it contains no fossil remains. In the United States gneiss is a common rock, especially in New England and the eastern and southern parts of New York.

GNOME (nōm), a short, pithy saying, often expressed in figurative language, containing a reflection, a practical observation, or a moral maxim. Among the Greeks Theognis, Phocylides, and others are called the gnomic poets, from their sententious manner of writing.

GNOME (nōm), in the cabalistic and mediæval mythology, the name given to the spirits which dwell in the interior of the earth, where they watch over mines, quarries, and hidden treasures. They assume a variety of forms, but are generally grotesque dwarfs, ugliness being their appropriate quality, though the females, gnomides, are originally beautiful.

GNOSTICS (nos'tiks), a general name applied to early schools of speculators, which combined the fantastic notions of the oriental systems of religion with the ideas of the Greek philosophers and the doctrines of Christianity. They nearly all agreed on the points that God is incomprehensible; that matter is eternal and antagonistic to God; that creation is the work of the Demiurge, an emanation from the Supreme Deity, subordinate or opposed to God; and that the human nature of Christ was a mere deceptive appearance. Certain forms of Gnosticism are mere adaptations of the Persian dualism to the solution of the problem of good and evil; while the pantheism of India seems to have been a pervading influence in others. Simon the magician (Simon Magus), of whom Luke speaks in the Acts of the Apostles, is generally looked on as the first of the Gnostics. There have been no Gnostic sects since the 5th century; but many of the principles of their system of emanations reappear in later philosophical systems, drawn from the same sources as theirs.

GNU, the wildebeeste of the colonists, the name given to two species of South African antelope. The former species is now rarely found south of the Vaal; its form partakes of that of the antelope, ox, or horse. Both sexes have horns

Common or white-tailed gnu.

projecting slightly outward and downward, then forming an abrupt upward bend. They have bristly black hair about the face and muzzle, a white stiff mane, and horse-like tail. They attain a length of about nine feet, and stand about four feet high at the shoulder. They live in herds; are said to be fierce when attacked, but when taken young have been found to be capable of domestication. The brindled gnu is larger than the common gnu, has black stripes on the neck and shoulders, and a black tail. Both species wheel in a circle once or twice before setting off when alarmed.

GOA, a city in Hindustan, on the Malabar coast, capital of the Portuguese territory of the same name. The name is applied to two distinct places, namely, Old Goa, and New Goa or Panjim. The former was once the chief emporium of commerce between the East and West, and had a population of 200,000, but it is now nearly deserted, though some pains are taken to keep the ancient churches and convents in repair. New Goa or Panjim was chosen as the residence of the Portuguese viceroy in 1759; and in 1843 it was made the capital of Portuguese India. The trade of Goa, at one time the most extensive of any place in India, is now inconsiderable. Pop. 8440. The territory around Goa belonging to the Portuguese has an area of 1062 sq. miles. It is well watered and fertile. About two-thirds of the total population, numbering 494,836, are the descendants of Hindus converted to Christianity on the subjugation of the country by the Portuguese.

GOALPA'RA, a district of British India, prov. of Assam; area 3897 sq. miles; pop. 452,304.

GOAT, a well-known horned ruminant quadruped. The horns are hollow, erect, turned backward, annular on the surface, and scabrous. The male is generally

Goat of Cashmere.

bearded under the chin. Goats are nearly of the size of sheep, but stronger, less timid, and more agile. They frequent rocks and mountains, and subsist on scanty coarse food. Their milk is sweet, nourishing, and medicinal, and their flesh furnishes food. Goats are of almost interminable variety, and it is not certainly known from which the domestic goat is descended, though opinion favors the wild goat of Western Asia. Goats are generally subdivided into ibexes and goats proper. They are found in all parts of the world, and many varieties are valued for their hair or wool. The skin is prepared for a variety of purposes, and yields the leather well known under the name of morocco. The cashmere goat, as its name indicates, is a native of Cashmere; it is smaller than the common domestic goat, and has long silky, fine hair. The angora goat is also furnished with soft silky hair of a silver white color, hanging down in curling locks 8 or 9 inches long. Its horns are in a spiral form, and extend laterally.

GOATSUCKER, a name common to certain birds, as also to all belonging to the same family from the erroneous opinion that they suck goats. The European goatsucker feeds upon nocturnal insects, as moths, gnats, beetles, etc., which it catches on the wing, flying with its mouth open. Its mouth is compara-

Goatsucker.

tively large, and lined on the inside with a glutinous substance to prevent the escape of those insects which fly into it. It has a light, soft plumage, minutely mottled with gray and brown, and is about 10 inches in length. The American chuckwill's widow, whip-poor-will, and night-hawk belong to the same family.

GOBELINS (gob-lan), **MANUFACTORY,** a tapestry manufactory at Paris, established by Colbert in 1667, on the site of a previously existing manufactory which had been set up by Gilles Gobelin, a celebrated dyer in the reign of Francis I. Colbert collected into it the ablest workmen in the divers arts and manufactures connected with house decoration and upholstery. The Gobelins has since then continued to be the first manufactory of the kind in the world. Many celebrated paintings of the old Italitan, French, and Spanish schools have, in the most ingenious manner, been transferred to tapestry.

GOBI, Desert of, the Shamo or "sand-sea" of the Chinese, an immense tract of desert country, occupying nearly the center of the high table-land of Eastern Asia, between lat. 37° and 48° n., and long. 95° and 118° e., and extending over a large portion of the Chinese territory of Mongolia. Its length is probably about 1000 miles; mean breadth, between 350 and 400 miles; area, 360,000 sq. miles. Its general elevation is over 4000 feet above sea-level.

GOD, the self-existent, eternal, and Supreme Being, the creator and upholder of the universe, worshiped by most civilized nations. The Christian God is an infinite and absolute being; a perfect personal spirit; eternal; immutable; omniscient; omnipotent; and perfectly good, true, and righteous. The arguments for the existence of God have been divided into the ontological, the cosmological, the psychological, the physico-teleological, and the moral. The ontological argument starts from the idea of God itself, and professes to demonstrate the existence of God as a necessary consequence from that idea. This form of argument is, in some shape or other, a very old one, but was first

fully developed and applied by Anselm in the 11th century. The manner in which it was stated by Anselm is this: "God must be thought of as that being than whom none can be thought greater; but this being the highest and most perfect that we can conceive, may be thought as existing in actuality as well as in thought—that is to say, may be thought as something still greater; therefore, God, or what is thought as greatest, must exist not only in thought but in fact." This argument has been presented in other forms. Descartes, while refuting Anselm's form of the ontological argument, revived it himself in another form. Applying the test of truth which he derived from his celebrated formula—"I think, therefore I am," that whatever we clearly and distinctly perceive to belong to the true and unalterable nature of a thing may be predicated of it, he found on investigating God that existence belongs to his true and unalterable nature, and therefore may legitimately be predicated of him. Another argument was adduced by Descartes to prove the existence of God, which, although not the same with the ontological argument, appears to resemble it. It is called the psychological argument. Like the ontalogical argument, it starts from the idea of a supreme and perfect being, but it does not assert the objective existence of that being as implied in its idea, but infers such objective existence on the ground that we could have acquired the idea only from the being which corresponds to it. The cosmological argument starts not from an idea, but from a contingent existence, and infers from it an absolutely necessary being as its cause. Stated syllogistically the argument is: Every new thing and every change in a previously existing thing must have a cause sufficient and pre-existing. The universe consists of a system of changes. Therefore the universe must have a cause exterior and anterior to itself. The argument called the physico-teleological is that which is commonly known as the argument from design, which has been so fully illustrated by Paley in his Natural Theology. It is simply this, that in nature there are unmistakable evidences of the adaptation of means to ends, which lead us inevitably to the idea of one that planned this adaptation, that is, of God. The moral argument is derived from the constitution and history of man and his relations to the universe, being based on such considerations as our recognition of good and evil, right and wrong, the monitions of conscience, and the fact that a moral government of the world may be observed. Another argument is based on the (alleged) fact that a belief in the existence of a Supreme Being is everywhere found to be implanted in the breast of man. This argument is used among others by Cicero, and many thinkers are inclined to give a good deal of weight to it; still it is pronounced by others to be at best only a probable argument, if it may be accepted as valid to prove anything at all. Others argue the existence of God from the manifestations which he has made of himself to men, but these, as well as miracles, it is admitted even by Christians theists, can only be accepted as real by such as previously believed in the divine existence.

GODA'VARI, a large river of Central India, which rises about 50 miles from the shores of the Indian Ocean, flows across the Deccan from the Western to the Eastern Ghats in a general south-easterly direction, and being joined by several affluents, falls by three principal mouths into the Bay of Bengal, after a course of 900 miles. Before the river divides there are three great obstacles to navigation, caused by three rocky barriers.—Godavari is also the name of a British district of the Madras Presidency; area, 7857 sq. miles; pop. 2,078,-782. Coringa and Coconada are its chief ports.

GODFREY OF BOUILLON, leader of the first crusade, son of Eustace II., count of Boulogne, born near Nivelles, 1061; died at Jerusalem, 1100. He distinguished himself while fighting for the Emperor Henry IV. in Germany and Italy, and was made Duke of Bouillon. In order to expiate his sin of fighting against the pope, he took the cross for the Holy Land in 1095, and led 80,000 men to the East by way of Constantinople. The defeat of the Egyptians at Ascalon placed him in possession of all the Holy Land, excepting two or three places. Godfrey now turned his attention to the organization of his newly-established government, and promulgated a code of feudal laws called the Assize of Jerusalem. Godfrey was a favorite subject of mediæval poetry, and is the central figure of Tasso's "Jerusalem Delivered."

GODI'VA, the wife of Leofric, Earl of Mercia and lord of Coventry in the reign of Edward the Confessor, heroine of a celebrated tradition. In 1040 certain exactions imposed on the inhabitants bore heavily on them, and Godiva interceded for their relief. Leofric, however, only laughed at her, and when she persisted in her entreaties at last said to her, half jocularly, that he would grant her request if she would ride naked through the town of Coventry. Godiva took her husband at his word, proclaimed that on a certain day no one should leave his house before noon, that all windows and other apertures in the houses should be closed, and that no one should even look out until noon was past. She then mounted naked on her palfrey, rode through the town, and returned; and Leofric, in fulfillment of his promise, freed the inhabitants from the burdens he had imposed on them. Only one person, "Peeping Tom," the story says, attempted to look out, and he was immediately struck blind. A yearly pageant, in which a young woman enacted the part of Godiva, was long kept up at Coventry, and still occasionally takes place. Tennyson's poem on Godiva is well known.

GOD'KIN, Edward Lawrence, American editor, was born in Moyne, County Wicklow, Ireland, in 1831. In 1856 he came to the United States, where he read law under David D. Field, was admitted to the bar in 1859. In 1865 he established and became the editor of the Nation. In 1881 the Nation was merged with the Evening Post, of which it became the weekly edition, and was thereafter editor and proprietor of the combined publications. His editorials in the Nation from the first influenced in manifold ways the best thought of the time, and he made the Evening Post, of which he became editor-in-chief in 1883, the leading independent American daily. He died in 1902.

GODWIN, Earl of Wessex, an Anglo-Saxon noble, born about 990; died 1052. In 1018 he was created an earl by Canute, and married the king's niece Gytha. During the reign of Edward the Confessor, who married Godwin's daughter, a quarrel arose between Godwin and the king, occasioned by the partiality of Edward for Norman favorites, and Godwin was compelled to quit the kingdom. In 1052, however, he returned with an army, forced Edward to enter into negotiations with him, re-established himself triumphantly in his old supremacy, and caused the expulsion from the kingdom of most of the Norman intruders. He was the father of Harold, the last Anglo-Saxon king.

GOETHE (geu'tê), Johann Wolfgang von, the greatest figure in German literature, was born August 28, 1749, at Frankfort-on-the-Main, died at Weimar, March 22, 1832. He was sent to the University of Leipzig to prepare himself for the legal profession, but he did not follow any regular course of studies. Goethe began at this period what he practiced throughout his life, to embody in a poem, or in a poetical form, whatever occupied his mind intensely; and no one, perhaps, was ever more in need of such an exercise, as his nature continually hurried him from one extreme to another. In 1768 he left Leipzig, and after an illness of some length went in 1770 to the University of Strasburg, to pursue the study of law, according to the wish of his father. In 1771 he took the degree of doctor of jurisprudence, and wrote a dissertation on a legal subject. He then went to Wetzlar to practice law, where he found, in his own love for a betrothed lady, and in the fate of a young man named Jerusalem, the subjects for his striking work, The Sorrows of Werther, which formed an epoch in German literature. The attention of the public had already been attracted to him, however, by his drama Götz von Berlichingen (published 1773). Werther appeared in 1774. Not long after the publication of Werther, Charles Augustus, the hereditary duke of Saxe-Weimar, made the acquaintance of Goethe on a journey, and when in 1775 he took the government into his own hands, he invited Goethe to his court. Goethe accepted the invitation, and on the 7th of November, 1775, arrived at Weimar. In 1776 he was made privy-councillor of legation, with a seat and vote in the privy-council. In 1782 he was made president of the chamber, and ennobled. In 1786 he made a journey to Italy, where he remained two years, visited Sicily, and remained a long time in Rome. This residence in Italy had the effect of still further developing his artistic powers. Here his Iphigenia was matured, Egmont finished, and Tasso projected. The first of these was pub-

lished in 1787, the second in 1788, and the third in 1790. In the same year with Tasso was published the earliest form of the first part of Faust, with the title Dr. Faust, ein Trauerspiel (Dr. Faust, a Tragedy), a poem in a dramatic form, which belongs rather to Goethe's whole life than to any particular period of it. In 1794–96 Goethe published Wilhelm Meister's Lehrjahre (Wilhelm Meister's Apprenticeship), a novel which has become well known to English readers through the translation of Carlyle, and which had as a continuation Wilhelm Meister's Wanderjahre (that is, his travels as a journeyman; 1821). His next work of importance was Hermann und Dorothea (1797), a narrative poem, in hexameter verse, the characters of which are taken from humble life. In 1806 Goethe married Christiane Vulpius, with whom he had lived since 1788, and of whom he always spoke with warmth and gratitude for the degree in which she had contributed to his domestic happiness. In 1808 he published another edition of Faust in a considerably altered form. In 1809 was published Elective Affinities. In 1811-14 appeared Goethe's autobiography, in 1819 the Westöstlicher Divan, a remarkable collection of oriental songs and poems. Goethe's last work was the second part of Faust, which was completed on the evening before the last anniversary of his birthday which he lived to see.

GOG AND MAGOG, Ezekiel predicts the destruction of Gog and Magog (ch. xxxviii and xxxix,) by the Jews, and mention is also made of them in Revelation (ch. xx.). Interpreters generally understand them to be symbolical expressions for the heathen nations of Asia. Magog is mentioned as the second son of Japheth in Genesis (ch. x, 2). Gog and Magog are also the names given to two reputed giants of early British history, whose statues are erected in the Guildhall in London. These statues are supposed to have been originally made for carrying about in pageants. The present figures of Gog and Magog, which are 14 feet high, were erected in 1708.

GOGAL, Nikolai Vassiljevich, Russian author, born in the province of Poltava 1809, died in 1852. Among his most notable works are—Evenings at the Farm (1832); Mirgorod, a collection of Tales (1834); the Dead Souls (1842), a satirical novel, depicting the public abuses and barbarism of manners prevalent in the provinces and Revisor, a comedy. His later years were tinged with religious mysticism, and he wrote some curious Confessions.

GOITRE (goi'tẽr), or **BRONCHOCELE,** a disease endemic in Derbyshire, Switzerland, some parts of France and South America, and in many other parts of the world, chiefly in valleys and elevated plains in mountainous districts. It is a morbid enlargement of the thyroid gland, forming a soft and more or less mobile tumor or swelling, without any sign of inflammation, on the anterior part of the neck. It sometimes grows to such a size as to hang down over the breast, and respiration and swallowing may be impeded by it, though often it causes little inconvenience. It is regarded as the result of a combination of causes, among which malarial influences probably concur with those of the drinking water in developing the disease.

A female affected with goitre.

GOLD, a precious metal of a bright yellow color, and the most ductile and malleable of all the metals; symbol Au (Lat. aurum); atomic weight, 196. It is one of the heaviest of the metals, and not being liable to be injured by exposure to the air, is well fitted for coin and jewerly. Its ductility and malleability are very remarkable. It may be beaten into leaves so exceedingly thin that 1 grain in weight will cover 56 square inches, such leaves having the thickness of only $\frac{1}{282000}$th part of an inch. It is also extremely ductile; a single grain may be drawn into a wire 500 feet long, and an ounce of gold covering a silver wire is capable of being extended upward of 1300 miles. It may also be melted and remelted with scarcely any diminution of its quantity. It is soluble in nitro-muriatic acid or aquatzegia, and in a solution of chlorine. Its specific gravity is 19·3, or it is about nineteen times heavier than water. The fineness of gold is estimated by carats, pure gold being 24 carats fine. Jeweler's gold is usually a mixture of gold and copper in the proportions of three-fourths of pure gold with one-fourth of copper. Gold is seldom used for any purpose in a state of perfect purity on account of its softness, but is combined with some other metal to render it harder. Articles of jewelry in gold are made of every degree of fineness up to 18 carats, i. e. 18 parts of gold to 6 of alloy. The alloy of gold and silver is found already formed in nature, and is that most generally known. It is distinguishable from that of copper by possessing a paler yellow than pure gold, while the copper alloy has a color bordering upon reddish yellow. Palladium, rhodium and tellurium are also met with as alloys of gold.

Gold has been found in smaller or larger quantities in nearly all parts of the world. It is commonly found in reefs or veins among quartz, and in alluvial deposits. It is separated, in the former case, by quarrying, crushing, washing, and treatment with mercury. The rock is crushed by machinery, and then treated with mercury, which dissolves the gold, forming a liquid amalgam, after which the mercury is volatilized and the gold left behind. Other processes are also in use. In alluvial deposits it is extracted by washing, in dust, grains, laminæ, or nuggets. Previous to the use of water, crushing may have to be employed. In modern times large supplies of gold were obtained after the discovery of America from Peru, Bolivia, and other parts of the New World. A chief source of the supply has long been the Ural Mountains, whence gold is still obtained. An immense increase in the world's production was caused by the discovery of gold in California in 1848, and Australia in 1851. Goldmines are also extensively worked in New Zealand, and considerable quantities of the precious metal have been obtained in British Columbia, and elsewhere in Canada. In the United States, apart from California, gold in considerable quantities is found in several states and territories (especially Colorado). The production of both Australia and America has shown much fluctuation in recent years, and latterly a very rich source of supply has been discovered in South Africa (the Transvaal). It is only since 1886 that the Transvaal has risen into importance as a gold-producing country, the chief locality where the metal is mined being the Witwatersrand. There are also gold-mines in India that are worked with great success. In Western Australia also many mines have recently been opened (Coolgardie being the chief center), and the Yukon district of Canada (Klondike) is now a recognized gold-field. British Guiana also begins to promise well as a gold-yielding country. Gold has been found in various parts of the United Kingdom, as in Sutherlandshire, the Wicklow hills, and many places in Wales. The total value of the gold produced throughout the world, from 1493 to 1850, is estimated at $3,314,500,000 and from 1851 to 1885, at $4,452,500,000. In 1887 the world's production was estimated at $110,000,000; in 1898 at about 300,000,000; in 1906, $400,245,300. Enormous quantities of gold are consumed in the arts and are lost by wear of coin and jewelry.

GOLD-BEATING, the art or process of producing the extremely thin leaves of gold used in gilding, etc. The gold is cast into ingots weighing about 2 oz. each, and measuring about ¾ of an inch broad. These ingots are passed between steel rollers till they form long ribbons of such thinness that a square inch will weigh 6½ grains. Each one of these is now cut into 150 pieces, each of which is beaten on an anvil till it is about an inch square. These 150 plates are interlaid with pieces of fine vellum about 4 inches square, and beaten till the gold is extended nearly to the size of the vellum leaves. Each leaf is then divided into four, interlaid with gold-beater's skin, and beaten out to the dimensions of the skin. Another similar division and beating finishes the operation, after which the eaves are placed in paper books ready for use.

GOLD COAST, a British crown-colony in West Africa, on the Guinea coast, extending from 3° 30′ w. to 1° 30′ e. lon., between Germany Togoland and the French Ivory Coast, and stretching inland so as to include the Ashantee country; estimated area, 75,000 sq. miles. Pop. 1,486,000.

GOLDEN AGE, that early mythological period in the history of almost all races, fabled to have been one of primeval innocence and enjoyment, in which the earth was common property, and

brought forth spontaneously all things necessary for happy existence, while beasts of prey lived at peace with other animals. The Romans referred this time to the reign of Saturn. The so-called "golden age" of Roman literature is reckoned from the time of Livius Andronicus, 250 B.C., to the death of Augustus Cæsar, A.D. 14.

GOLDEN-BEETLE, the popular name of several beetles. There are some British species, most are tropical. Their most obvious characteristic is the great brilliancy of their color. There are none of large size.

GOLDEN-CRESTED WREN, Golden-crested Regulus, or Kinglet, a beautiful bird distinguished by an orange crest. It is the smallest of British birds, being only about 3½ inches in length, is very agile, and almost continually in motion. The eggs are nine or ten in number.

GOLDEN FLEECE, in classical myth. the fleece of gold in quest of which Jason undertook the Argonautic expedition to Colchis. The fleece was suspended in an oak tree in the grove of Ares (Mars), and was guarded by a dragon. When the Argonauts came to Colchis for the fleece, Medea put the dragon to sleep and Jason carried the fleece away.

GOLDEN FLEECE, Order of the, the Toison d'or, a military order instituted by Philip the Good, Duke of Burgundy, in 1429, on the occasion of his marriage with the Portuguese princess, Isabella. The order now belongs to both Austria and Spain. The knights carry suspended from their collars the figure of a sheep or fleece in gold.

GOLDEN HORN, the harbor of Constantinople, an inlet of the Bosphorus, so called from its shape and beauty.

GOLDEN-ROD, is a genus of plants, chiefly natives of North America. Most of the species have erect, rod-like, scarcely-branched stems, with alternate serrated leaves, and terminal spikes or racemes of small yellow flowers.

GOLDFINCH, a bird belonging to the Finch family. It is about five inches in entire length, black, scarlet, yellow and white being beautifully mingled in its

The common goldfinch.

plumage. The colors of the female are duller than those of the male. Its brilliant plumage, soft and pleasant song and docility make it a favorite cage-bird. Gold-finches feed on various kinds of seeds, particularly those of the thistle, dandelion, and groundsel.

GOLDFISH, the name of a beautiful species of carp, found in the fresh waters of China. It is greenish in color in the natural state, the golden yellow color being found only in domesticated specimens, and retained by artificial selection. These fishes are reared by the Chinese in small ponds, in basins, or porcelain vessels, and kept for ornament. By careful selection, many strange varieties and monstrosities have been propagated. They are now distributed over nearly all the civilized parts of the world, but in large ponds they readily revert to the color of the original stock.

GOLD LACE, a fabric woven of silken threads which are either themselves gilt or are covered with fine gilt silver wire. In the former the gold-leaf is fixed directly on the threads by means of gum. In the latter and finer kind the fine gilt silver wire is twisted compactly round the silk threads, which are then ready for being manufactured into lace.

GOLDSCHMIDT, MADAME. See Lind, Jenny.

GOLDSMITH, Oliver, poet and miscellaneous writer, born Nov. 10, 1728, at Pallas county Longford, Ireland, died in London April 4, 1774. In 1761 he was introduced to Dr. Johnson. In 1764 he appeared as a poet by the publication of

Oliver Goldsmith, from the statue by Foley.

his Traveler. In 1766 appeared his Vicar of Wakefield, which at once secured merited applause. His poetical fame was greatly enhanced by the publication of his Deserted Village in 1770. In 1773 he produced his comedy of She Stoops to Conquer, which was completely successful. He also compiled histories of England, Greece, and Rome; and a History of the Earth and Animated Nature, a pleasing work, but one of no scientific value. The manners of Goldsmith were eccentric, even to absurdity. As a poet, his Traveler and Deserted Village have given him a deserved reputation; and his Vicar of Wakefield is one of the best known and most delightful of English novels.

GOLF, a game played with clubs and balls, generally over large commons, downs, or links, where a series of small round holes are cut in the turf at distances of from 100 to 500 yards from each other, according to the nature of the ground, so as to form a circuit or round. The clubs are of different uses, and have different names according to the purpose for which they are respectively designed; as the driver, putter, brassey, mashie, cleek, iron, niblick, etc. The rival players are one on each side, or two against two, in which case the two partners strike the ball on their side alternately. The object of the game is, starting from the first hole, to drive the ball into the next hole with as few strokes as possible, and so on with all the holes in succession, the side which "holes" its ball on any occasion with the fewest strokes being said to gain the hole. The match is usually decided by the greatest number of holes gained in one or more rounds, or the aggregate number of strokes taken to hole one or more rounds. In medal play the score is always reckoned by strokes.

GOL'GOTHA. See Calvary.

GOLI'ATH, a giant of Gath slain by David (1 Sam. xvii.). His height was "six cubits and a span," which, taking the cubit at 21 inches, would make him a little over 11 feet. The Septuagint and Josephus read, "four cubits and a span."

GOLOSH'ES, a word introduced into our language from the French galoche, but originally derived from the Spanish galocha, meaning a wooden shoe or clog. It was formerly applied by the English to a kind of wooden clog. The name is now restricted to overshoes, now generally made of vulcanized india-rubber.

GOMEZ Y BAEZ, Maximo, Cuban general, born in 1826 at Bani, Santo Domingo. He served in the Spanish army in Santo Domingo and in Cuba. He left the Spanish army, settled down as a planter, and in the insurrection of 1868–78 joined the insurgents, and was made colonel by the Cuban president Céspedes. He became general-in-chief of the forces of the Republic of Cuba in 1895, when the second revolution broke out, and was especially active in Camaguey, where his perfect familiarity with the country stood him in good stead. He did little open fighting, but accomplished much by harassing the Spaniards and destroying their supplies. He put his small force at the disposal of the Americans as soon as they landed in Cuba, and was markedly friendly to this country. In March, 1899, he was deposed from his supreme command by the Cuban assembly for traitorously receiving for his army the three million of dollars voted by the United States government. He died in 1906.

GOMOR'RAH. See Sodom and Gomorrah.

GOM'PERS, Samuel, American labor leader, born in London, England, in 1850. He came to the United States in 1863, and in 1864 became the first registered member of the Cigar-makers' international union, of which he was secretary and president, and which he made one of the most successful of American trades unions. He was elected vice-president of the Federation of labor in 1881, and from 1882, with the exception of the year 1894, when he was defeated by John McBride, representing the coal-miners, was its president. Among the state and federal laws passed at his instance are the eight-hour law for government work, the ten-hour law for the employees of street railways, and that making the first Monday of September a legal holiday with the title "Labor Day." His writings include pamphlets on labor matters.

GÔN'DOLA, a sort of barge, curiously ornamented, and navigated on the canals of Venice. The middle-sized gondolas are upwards of 30 feet long and 4 broad; they always terminate at each end in a very sharp point, which is

raised perpendicularly to the height of a man. Toward the center there is a curtained chamber for passengers.

Gondola.

GON'FALON, an ensign or standard; especially an ensign having two or three streamers or tails, fixed on a frame made to turn like a ship's vane, or, as in the case of the Papal gonfalon, suspended

Gonfalon.

from a pole similarly to a sail from a mast. The person intrusted with the gonfalon in many of the mediæval republican cities of Italy was often the chief personage in the state.

GONG, a Chinese musical instrument made of an alloy of copper (about seventy-eight parts) and tin (about twenty-two parts), in form like a round flat dish with a rim 2 to 3 inches in depth. It is struck by a kind of drumstick, the head of which is covered with leather, and is used for the purpose of making loud sonorous signals, of marking time, and of adding to the clangor of martial instruments.

GONORRHŒA (gon-o-rē'a), a specific contagious inflammation of the male urethra or the female vagina, attended, from its early stages, with a profuse secretion of much mucus intermingled with matter. This secretion contains the contagion of the disease. Though termed a venereal disease, it is totally distinct from syphilis. It is a painful disease, and may result in the chronic catarrh called gleet, or may lead to stricture and other serious evils.

GONSAL'VO, Hernandez y Aguilar, de Cordova, Spanish soldier, called the great captain, was born at Montilla, near Cordova, in 1453, died at Granada 1515. He distinguished himself in the Portuguese war which began in 1475, and in the great war with the Moors, which ended with the conquest of Granada in 1492. In 1495 he was sent to assist Ferdinand II., king of Naples, against the French, who occupied the whole of that kingdom. In less than a year Gonsalvo drove the French over the Neapolitan frontiers, and returned to Spain, where he was engaged in subjecting the Moors in the Alpujarras, when Louis XII. of France renewed the war against Naples. Gonsalvo again took the field, and by the victory near Seminara in 1502 obtained possession of both Calabrias. In 1503 he gained a still more important victory near Cerignola, in consequence of which Abruzzo and Apulia submitted, and Gonsalvo marched into Naples. He then sat down before Gaëta. As the siege was protracted, he gave up the command to Don Pedro Navarro, and advanced to meet the enemy. He defeated the Marquis of Mantua; and on the Garigliano, with 8000 men, obtained a complete victory over 30,000 French, the consequence of which was the fall of Gaëta. The possession of Naples was now secured. He was viceroy in Italy until 1507, when, through the jealousy of the king and the calumnies of the courtiers, he was deprived of his office, and retired to Granada, where he died.

GONZAGA FAMILY, a famous Italian family who ruled over Mantua for over three centuries Many illustrious soldiers, statesmen, churchmen, and promoters and cultivators of arts, science, and literature sprang from this stock. They became extinct in 1708.

GOOD-FRIDAY, a fast of the Christian Church in memory of our Savior's crucifixion, kept on the Friday of Passion-week, that is the Friday before Easter. It has been celebrated from a very early period. In the Roman Catholic Church the celebration of this fast includes prayers for all classes of people, including heretics, schismatics, pagans, and Jews, and the "Adoration of the Cross," but no mass is celebrated. In Protestant churches, with but a few exceptions, the day is observed with more or less solemnity. The practice of eating "cross-buns" on this day has now no religious significance.

GOOD HOPE, Cape of. See Cape of Good Hope.

GOODRICH, Samuel Griswold, American author, born at Ridgefield, Connecticut, 1793; died 1860. He is best known as "Peter Parley," a pseudonym which he assumed in writing, editing, and compiling upwards of 100 children's books. In 1851 he acted as American consul at Paris, and published there in French a treatise on American Geography and History. He also wrote Recollections of a Lifetime; Sketches from a Student's Window; A History of all Nations; The Outcast and other Poems; and a general Natural History.

GOODS AND CHATTELS, a legal as well as popular phrase, in common use, to signify personal property. It is not unfrequently used in wills, but seldom in any other legal instrument; and when used in wills, it generally includes all the personal property of the testator. The two words are not identical in meaning, however, the term chattels being the more extensive in signification and including the other. The term goods corresponds closely in meaning to the bona of the common law, and to movables of the civil law, whereas, chattels includes as well certain rights in land.

GOOD TEMPLARS, a temperance brotherhood which combines the principles of teetotalism with certain mystic rites, imitated more or less from free masonry, having secret signs, passwords, and insignia peculiar to itself. It originated in New York in 1851, and extended to Britain in 1868. The organization consists of local "subordinate" lodges, county "district" lodges, national "grand" lodges, and an international "right worthy" grand lodge. A "juvenile order" is also attached.

GOOD-WILL, the benefit derived from a business beyond the mere value of the capital, stock, funds, or property employed in it, in consequence of the general public patronage and encouragement which it receives from constant and habitual customers. It is legally considered a subject of sale along with the stock, premises, fixtures, trade debts, etc.

GOOSE, the common name of a well-known family of natatorial birds. The domestic goose lives chiefly on land and feeds on grass; there are many varieties, but they do not differ widely from each other. It is valued for the table, and on account of its quills and fine soft feathers. The common wild goose, or grey-lag, which is migratory, is believed to be the original of the domestic goose. The Snow-goose of North America is 2 feet 8 inches in length, and its wings are 5 feet in extent. The bill of this bird is very curious, the edges having each twenty-three indentations or strong teeth on each side. The inside or concavity of the upper mandible has also seven rows of strong, projecting teeth, and the tongue, which is horny at the extremity, is armed on each side with thirteen long and sharp bony teeth. The flesh of this species is excellent. The Laughing or White-fronted Goose inhabits the northern parts of both continents, and migrates to the more temperate climates during the winter. The Bean-goose is also common to both continents. The Canada-goose is the common wild goose of the United States, and is known in every part of North America. It is also found in Europe, and even breeds in Britain.

GOOSEBERRY, a low, branching shrub, growing wild in Siberia and the north of Europe, other species being found in N. America. The branches are armed with numerous prickles, and bear three to five lobed leaves and inconspicuous flowers. The fruit is a succulent berry, very wholesome and agreeable, of various colors—whitish, yellow, green, and red. Gooseberries are popular fruits for preserving, and are extensively cultivated, being of very easy culture. They may be raised from slips, which is the usual mode of perpetuating varieties; new varieties are raised from seed. The plant of four years old produces the largest and finest fruit; afterward the fruit becomes smaller but increases in quantity. An American species has fine white flowers, and is cultivated as an ornamental shrub.

GOPHER, the name of various burrowing animals, natives of N. America The pouched rat has large cheek-pouches extending from the mouth to the shoulders, incisors protruding beyond the lips, and broad, mole-like fore-feet Several American burrowing squirrels also get this name, as also a species o-

burrowing land-tortoise of the Southern States, whose eggs are valued for the table.

GOPHER-WOOD, the wood of which Noah's ark was built, but whether it was cypress, pine, or other wood is an unsettled point.

GORAKHPUR, a town of Hindustan, United Provinces, and division of Benares, capital of the district of same name, on the left bank of the Rapti. It has a considerable trade in grain and timber, sent down the Rapti to the Gogra and the Ganges. Pop. 64,148.—The district has an area of 4598 square miles. It is generally flat, and traversed by numerous streams of which the principal are the Rapti and larger Gandak. Pop. 2,994,057.

GORDIAN KNOT. See *Gordius*.

GORDIUS, in Greek legend, a Phrygian peasant, father of Midas, who was raised to the Phrygian throne in accordance with an oracle which declared to its Phrygian consulters that their seditions would cease if they elected as king the first man they met, mounted on a chariot, going to the temple of Zeus. This was Gordius, who, to evince his gratitude, consecrated his chariot to Zeus, and fastened the pole with so ingenious a knot that the oracle promised the dominion of the world to him who should untie it. Alexander the Great cut it with his sword, and to "cut the Gordian knot" became a proverb.

GORDON, Charles George, British soldier, known also as "Chinese Gordon" and Gordon Pasha, was born at Woolwich 1833, killed at Khartoum 1885. He entered the Royal Engineers in 1852, and served in the Crimea (1854–56). During the Taeping rebellion in China, Gordon succeeded in completely crushing the revolt by means of a specially-trained corps of Chinese, exhibiting marvelous feats of skilful soldiership. On his return to England with the rank of colonel he was appointed chief engineer officer at Gravesend, where his military talents and philanthropy were conspicuously displayed. From 1874 to 1879 he was governor of the Soudan under the Khedive. For a few months in 1882 he held an appointment at the Cape, and he had just accepted a mission to the Congo from the king of the Belgians, when he was sent to withdraw the garrisons shut up in the Soudan by the insurgent Mahdi. He was shut up in Khartoum by the rebels, and gallantly held that town for a whole year. A British expeditionary force under Lord Wolseley was despatched for his relief; an advance corps of which sighted Khartoum on 24th January, 1885, to find that the town bad been treacherously betrayed into the hands of the Mahdi two days before, and Gordon murdered. Gordon's character was marked by strong religious feelings, which latterly became so intensified as to make him somewhat of a religious enthusiast and fatalist.

GORDON, John Brown, American soldier and politician, was born in Upson co., Ga., in 1832. In 1861 he entered the confederate army as captain of infantry, and rose to the grade of lieutenant-general. At the time of General Lee's surrender at Appomattox, General Gordon commanded one wing of the army. From 1873 to 1880, and from 1891 to 1897, he was a member of the United States senate, where he was one of the leaders of the democratic party, and was known as an eloquent speaker. From 1887 to 1890 he was governor of Georgia. He died in 1904.

GORGET, a piece of body armor, either scale work or plate, for the protection of the throat. The camail, or throat covering of chain mail, which is sometimes called the gorget of mail, belonged more to the helmet than to the body armor.

GORGONS, in Greek mythology, three frightful goddesses whose names were Stheno, Euryale, and Medusa. They were all immortal, except Medusa. Their hair was said to be entwined with serpents, their hands were of brass, their body was covered with impenetrable scales, their brazen teeth were as long as the tusks of a wild boar, and they turned to stones all those who looked upon them.

GORIL'LA, the largest animal of the ape kind. It attains a height of about 5½ feet or more, is found chiefly in the woody equatorial regions of Western Africa, is possessed of great strength and fierceness, is a great frequenter of trees,

Gorilla.

and feeds chiefly on vegetable substances, as roots and fruits. The erect position is more readily assumed by the gorilla than by most of the other anthropoid apes, owing to the shape of the sole of the foot, which is not inverted and is shorter and broader; but the ordinary gait is on all fours. It has a ferocious and brutal cast of features, due to the prognathism of the jaws, the extremely prominent supra-orbital ridges, and retreating forehead. Gorillas make a sleeping-place somewhat like a hammock, connecting the branches of a tree by means of the long, tough, slender stems of climbing plants, and lining it with dried fronds of palms or long grass. This abode is constructed at different heights from the ground, but there is never more than one such nest in a tree. The gorilla, like the chimpanzee, has thirteen ribs, whereas man and the orang have twelve. The gorilla and chimpanzee also have eight bones in the carpus or wrist, while the others have nine. The bones of the arm are much longer than in man, and the upper arm is longer than the forearm; the leg bones are shorter than in man. In the proportion of its molar teeth to the incisors and in the form of its pelvis it approaches somewhat closely the human form. It is less intelligent and docile than several other apes. The Phœnician navigator Hanno found the name in use in the 5th century B.C. in W. Africa.

GOR'KY, Maxim, a Russian author, was born at Nizhni-Novgorod in 1868. His story "Maker Chudra" appeared in the Tiflis Kavkaz in 1892, and was followed by a rapid series of works, of which Foma Gordyéeff, an international success, was the most noteworthy. Gorky's collected works appeared at Saint Petersburg in 1901. In 1906 he paid a short visit to the United States.

GORLITZ (geur'lits), a town in the Prussian government of Liegnitz, province of Silesia, on the left bank of the Neisse. It is well-built, having generally substantial houses, several large squares and spacious streets. Its industries include woolens, linens, and cottons, machinery, iron-founding, glass, porcelain, leather, soap, etc. The town was an important place for three centuries before the reformation; it afterward declined, but has rapidly increased in prosperity since the laying down of the railways; the population, which in 1831 was only 8000, was in 1906, 84,931.

GORMAN, Arthur Pue, American senator, was born in Howard co., Maryland, in 1839. In 1866 he was appointed collector of internal revenue in the fifth district of Maryland. In 1869 he was made general superintendent of the Chesapeake and Ohio canal company, and in 1872 its president. He was elected to the house of delegates in Maryland in 1870, and by re-election he held the office until 1875, during the last part of his term serving as the speaker. From 1875 to 1881 he was state senator. He was then elected United States senator and continued in that office until 1899. After three years of private life, he was again elected to the senate in 1902. He led the opposition to the force bill in 1889, and was one of the democratic senators who remodeled the Wilson tariff bill in 1894. He died in 1906.

GORTSCHAKOFF, Alexander Michaelovitch, Russian diplomatist, was born 1798, died 1883. He entered the diplomatic service in 1824, as secretary to the Russian embassy in London. His experience in diplomacy was extended in Vienna, Florence, Stuttgart, etc , and he showed considerable dexterity in securing the neutrality of Austria during the Crimean war. In 1856 he became minister of foreign affairs, and in 1862 chancellor of the empire. He was a prominent member of the Berlin Congress, 1878.

GORTSCHAKOFF, Prince Michael, Russian general, born in 1792, died 1861. He took part as an artillery officer in the battle of Borodino in 1812, and served in the subsequent campaigns of the allies against the French. He took a prominent part in

the Turkish war (1828–29); the Polish war (1831); the invasion of Hungary (1849); and in the war with Turkey and the western powers (1853–55). In the Crimea he held the command in Sebastopol during the siege. After the war he was made governor of Poland

GOSCHEN (gō'shen), George Joachim, politician and financier, born in London 1831, educated at Rugby and Oxford. He entered parliament in 1863. In 1865 he was sworn of the privy-council on becoming a member of the Russell ministry. In 1868 he became president of the poor law board, and subsequently first lord of the admiralty. In 1886 he succeeded Lord R. Churchill as chancellor of the exchequer under Lord Salisbury, and in 1895 he again took office under the same leader as first lord of the admiralty. In 1900 he was raised to the peerage as Viscount Goshen.

GOSHAWK, a raptorial bird of the hawk kind, The general color of the plumage is a deep brown, the breast and belly white. A full-grown female is 23 or 24 inches in length, the male a good deal smaller. It was formerly much used in falconry. This bird flies low, and pursues its prey in a line after it, or in the manner called "raking" by falconers. The female was generally flown by falconers at rabbits, hares, etc., and the larger-winged game, while the male was usually flown at the smaller birds, and principally at partridges.

GOSHEN, in ancient geography, a district of Egypt, which Joseph procured for his father and brethren. It is supposed that the land of Goshen lay between the eastern part of the ancient Delta and the western border of Palestine.

GOSPEL, Gospels. The Greek word for which gospel has been used as the equivalent is evangelion, or rather euaggelion, a good or joyful message. In the New Testament it denotes primarily the glad tidings respecting the Messiah and his kingdom—this was emphatically the gospel (Anglo-Saxon, gôd-spell, good tidings). It was quite naturally employed as a common title for the historical accounts which record the facts that constitute the basis of Christianity. It may be fairly said that the genuineness of the four narratives written by Matthew, Mark, Luke and John rests upon better evidence than that of any other ancient writings. They were all composed in the latter half of the first century; those of Matthew and Mark some years before the destruction of Jerusalem; that of Luke about the year 64; and that of St. John about the close of the century. Before the end of the 2d century we have abundant evidence that the four gospels as one collection, were generally used and accepted. While the early existence of these gospels has been admitted, much discussion has taken place regarding their origin, and their relation one to another. They seem to have been viewed as so many original and independent sources, each one as much so as the others. The critical spirit of modern times has refused to halt at this point; it has sought to get at, so to speak, the genealogy of the several gospels with their different degrees of relationship. Each of the four gospels has in turn been assumed by different critics to be the first out of which the others arose; and the theory has been more than once propounded of some prior, more strictly original document, no longer extant, which formed the common basis of them all. The supposition of an original document from which the three synoptical Gospels (those of Matthew, Mark, and Luke) were drawn, each with more or less modification, would naturally occur to those who rejected the notion that the evangelists copied from each other. The fourth Gospel, as the narrative coincides with that of the other three in a few passages only, is not drawn in to the discussion, and the received explanation is the only satisfactory one with respect to it, namely, that John, writing last, had seen the other gospels, and purposely abstained from writing anew what had been sufficiently recorded. Another conjecture is that the gospels sprang out of a common oral tradition. According to this view of the origin of the gospels, that of Mark, if not the oldest in composition, is yet probably the most direct and primitive in form; it is the testimony delivered by Peter, possibly with little alteration. The Gospels of Matthew and Luke, again, "represent the two great types of recension to which it may be supposed that the simple narrative was subjected. Luke represents the Hellenic, and Matthew the later Hebraic form of the tradition, and in its present shape the latter seems to give the last authentic record of the primitive Gospel." A comparison of the three synoptical Gospels yields some interesting results. If we suppose the history they contain to be divided into sections, in forty-two of these all the three narratives coincide; twelve more are given by Matthew and Mark only, five by Mark and Luke only, and fourteen by Matthew and Luke. To these must be added five peculiar to Matthew, two to Mark, and nine to Luke. But this applies only to general coincidence as to the facts narrated; the number of passages either verbally the same, or coinciding in the use of many of the same words, is much smaller. Briefly stated the critical result is as follows: There is a singular coincidence in substance in the three synoptical gospels. The verbal and material agreement is such as does not occur in other authors who have written independently of one another. The agreement would be no difficulty without the differences; it would only mark the one divine source from which they were all derived. The difference of form and style, without the agreement, would offer no difficulty, since there may be a substantial harmony between accounts that differ greatly in mode of expression and the very difference might be a guarantee of independence. Several biographies of Jesus and the holy family written by unknown authors of the 2d, 3d and later centuries are known as Apocryphal Gospels. They have no historical nor doctrinal value whatever. The titles of the best known of these are: The Gospel of James, The Gospel of Joseph the Carpenter; The Gospel of Thomas, The Gospel of Nicodemus, The Acts of Pilate, and his Letter to Tiberias, etc.

GOS'SAMER, is the name of a fine filmy substance, like cobweb, which is seen to float in the air in clear days in autumn, and is most observable in stubble-fields, and upon furze and other low bushes. This is formed by several kinds of small spiders, and only, according to some, when they are young.

GOTHARD, St., a mountain group, Switzerland, on the confines of the cantons Tessin and Uri, belonging to the Lepontine or Helvetian Alps, which it connects with the Bernese Alps. It forms a kind of central nucleus in the great watershed of Europe. Its culminating point has a height of 10,600 feet. The Col of St. Gothard, at its summit level, where the Hospice stands, is 6808 feet high. Over it an excellent carriage road was completed in 1832. A railway tunnel has been pierced through this mountain group between Göschenen on the north and Airolo on the south, thus directly connecting the railway system of North Italy with those of Switzerland and Western and Central Germany. This tunnel is the longest in the world, being of the total length of 16,295 yards, or rather more than 9¼ miles. Its construction, begun in 1872, was completed in 1881, and it was opened for traffic early in 1882.

GOTHIC ARCHITECTURE, a term applied to the various styles of pointed architecture prevalent in Western Europe from the middle of the 12th century to the revival of classic architecture

Gothic architecture—Salisbury cathedral.

in the 16th. The chief characteristics of Gothic architecture are: The predominence of the pointed arch and the subserviency and subordination of all the other parts to this chief feature; the tendency through the whole composition to the predominance and prolongation of vertical lines; the absence of the column and entablature of classic architecture, of square edges and rectangular surfaces, and the substitution of clustered shafts, contrasted surfaces, and members multiplied in rich variety. This style orginated in France and

spread very rapidly to England, Germany, Italy, Spain, and the Scandinavian countries. In England it was introduced by William of Sens, who built Canterbury Cathedral in 1174, and here followed an independent course of development. The Gothic architecture of Britain has been divided into four principal epochs—the Early English, or

Gothic Architecture.
ab, Early English windows. *c*, Transition. *d*, Geometrical. *e*, Perfect decorated. *fg*, Perpendicular.

general style of the 13th century; the Decorated, or style of the 14th century; the Perpendicular, practiced during the 15th and early part of the 16th century (Flamboyant being the contemporary style in France); and the Tudor, or general style of the 16th century.

GOTHS, an ancient Teutonic tribe occupying when first known to history the region adjacent to the Black Sea north of the lower Danube. A people of similar name is mentioned by Tacitus as dwelling south of the Baltic, and Geats or Gauts are known to us from the the Anglo-Saxon poem Beowulf as inhabitants of southern Sweden; but there is no necessary connection between these and the Goths proper. About the middle of the 3d century these began to encroach on the Roman Empire. Having seized the Roman province of Dacia, they were assailed by Decius, whom they twice defeated. In 253 they captured Trebizond, where a large fleet of ships fell into their hands. With this force they sailed down the Ægean and plundered the coasts of Greece and Illyria. They now began to threaten Italy, but in 269 they were defeated with great slaughter by the Emperor Claudius. His successor Aurelian was, notwithstanding, compelled to cede to them the large province of Dacia, after which there was comparative peace between them for many years. In the 4th century the great Gothic kingdom extended from the Don to the Theiss, and from the Black Sea to the Vistula and the Baltic. About the year 369 internal commotions produced the division of the Gothic kingdom into the kingdom of the Ostrogoths (eastern Goths) and the kingdom of the Visigoths (western Goths). In 396 Alaric, king of the Visigoths, made an irruption into Greece, laid waste the Peloponnesus, and became prefect of Illyria. He invaded Italy and sacked Rome in 409, and a second time in 410. After his death (in 410) the Visigoths succeeded in establishing a new kingdom in the southern parts of Gaul and Spain, of which, toward the end of the 5th century, Provence, Languedoc, and Catalonia were the principal provinces, and Toulouse the seat of government. The last king, Roderick, died in 711 in battle against the Moors, who had crossed from Africa, and subsequently conquered the Gothic kingdom. After the fall of the Western Roman Empire, by the invasion of Odoacer in 476, the Eastern emperor, Zeno, persuaded Theodoric, king of the Ostrogoths, to invade Italy in 489. The Goth became king of Italy, in 493, and laid the foundation of a new Ostrogothic kingdom, which, together with Italy, comprised Rhætia (a part of Switzerland and the Tyrol), Vindelicia (part of Bavaria and Swabia), Noricum (Saltzburg, Stiria, Carinthia, Austria), Dalmatia, Pannonia (Further Hungary, Slavonia), and Dacia beyond the Danube (Transylvania, Walachia). This kingdom came to an end in 554. Subsequently the Goths both here and in Spain entirely disappeared as a distinct people.

GOTTENBURG, or **GOTHENBURG,** a seaport town in Sweden, the second in respect of population and trade, capital of the län of the same name, situated at the mouth of the Göta, in the Kattegat,

255 miles w.s.w. Stockholm, intersected by canals. It is one of the best built towns in Sweden, and the seat of a bishopric. It has manufactures of sailcloth, cotton, and other goods, and possesses ship-building yards, tobacco factories, breweries, sugar refineries, etc. Pop. 130,619.

GOTTINGEN (geut'ing-en), a town of Prussia, province of Hanover, on the Leine, 59 miles s.s.e. Hanover. Its chief attraction is the university, founded in 1734 by George II. of England and elector of Hanover, opened in 1737 and which has a European reputation. It has an average attendance of over 1000 students. Connected with the university are a museum, an observatory, an anatomical theater, botanical garden, and a library possessed of 500,000 printed volumes and 5000 MSS. The manufactures comprise woolens, chemicals, scientific instruments, etc. Pop 30,234.

GOTTLAND, or **GOTHLAND,** an island of the Baltic, belonging to and 55 miles east of the coast of Sweden. Pop. 52,570

GOULD, Benjamin Apthorp, American astronomer, was born in Boston, Mass., in 1824. In 1852 he was appointed director of the longitude determinations of the coast survey, and in 1867, after having organized and greatly developed this service, retired. From 1855 to 1859 he was director of the Dudley observatory, at Albany, N. Y., and in 1866 he established by means of the Atlantic cable, the relations in longitude between America and European stations. In 1870 he established at Cordoba, Argentina, the National observatory, where he accumulated the material for his Uranometria Argentina and Catalogo de Zonas Estelares, both classic in the literature of astronomy. In 1872 with the assistance of the Argentine government, he further established a system of meteorological stations extending southward to Tierra del Fuego and eastward to the Atlantic. He died in 1896.

GOULD, Helen Miller, American philanthropist, was born in New York City in 1868. At the commencement of the Spanish-American war she presented $100,000 to the United States government, and during the war, as a member of the women's national war relief association, was prominently active. She gave $50,000 for necessary supplies for the care of soldiers in hospitals, and at Camp Wyckoff, near Montauk point, Long Island, did personal work in that connection. Her benefactions to New York university have also been notable, and include the library building of the university, with its well-known "Hall of Fame."

GOULD, Jay, an American capitalist, born in 1836 in Roxbury, Delaware co., N. Y. In the great financial depression following the panic of 1857 he bought a controlling interest in the Rutland and Washington railroad running from Troy, N. Y., to Rutland, Vt., for 10 cents on the dollar. Of this company he became president, treasurer, and general manager, and subsequently brought about a consolidation of his road and the Rensselaer and Saratoga Railroad. In 1859 he sold out his stock in the consolidated roads at 120, and removed to New York, where he embarked in the brokerage business. By methods new in railway speculation Gould secured control of the Erie railroad, and in 1868 was elected its president. The manipulation of the Erie was the first of a long series of speculations by which Gould obtained the mastery of some of the greatest railway corporations in the country. In 1880 he controlled fully 10,000 miles of road, more than one-ninth of the mileage of the country. Gould also consolidated competing telegraph lines into the Western Union system in 1881, and obtained control of the Manhattan elevated railroad in the same year. He died in 1892.

GOUNOD (gö-nō), Charles François, French operatic composer, born at Paris, 1817; his first important work was

Faust (1859), which raised him to a high rank among composers. Other operas followed, among which are Mireille (1864), Romeo et Juliette, Cinq Mars (1877), and Polyeucte (1878). He wrote also a Messe Solennelle, a motet Gallia, and other choral works and songs; oratorios, Redemption (1882), Mors et Vita (1885), and a Mass for the Jeanne D'Arc festival (1887). He died in 1893.

GOURD (görd), the popular name of a genus of plants. The same name is given to the different kinds of fruit produced by the various plants of this genus. These are held in high estimation in hot countries; they attain a very large size,

Flower and fruit of squash.

and most of them abound in wholesome nutritious matter. The pumpkin, acquires sometimes a diameter of 2 feet. The squash is cultivated in America as an article of food. The water melon serves the Egyptians for meat, drink and physic. The orange-fruited gourd is cultivated only as a curiosity, and is a native of the East Indies. The bottle gourd, a native both of the East and West Indies, is edible, and is often 6 feet long and 18 inches in circumference. The outer coat or rind serves for bottles and water-cups.

GOUT, a form of arthritis, a constitutional disorder giving rise to paroxysms of acute pain with a specific form of inflammation, appearing after puberty chiefly in the male sex, and returning after intervals. It is often preceded by, or alternates with, disorder of the digestive or other internal organs, and is generally characterized by affection of the first joint of the great toe, by nocturnal exacerbations and morning remissions, and by vascular plethora; various joints, organs, or parts becoming affected after repeated attacks without passing into suppuration. It may be acquired or hereditary. In the former case it rarely appears before the age of thirty-five; in the latter, it is frequently observed earlier. It appears that the disease is due to an excess of uric acid in the blood, this either being formed in the body in too large quantity, or not being removed from the blood by the kidneys in the urine as it ought to be. Indolence, inactivity, and too free use of tartareous wines, fermented liquors, and very high-seasoned and nitro-genous foods, are the principal causes which give rise to this disease. Gout is also called, according to the part it may affect, Podagra (in the feet), Gonagra (in the knees), Chiragra (in the hands), etc. It may be acute or chronic, and may give rise to concretions, which are chiefly composed of urate of soda. Strict regulation of the habits of life is one of the most important elements in the treatment of gout.

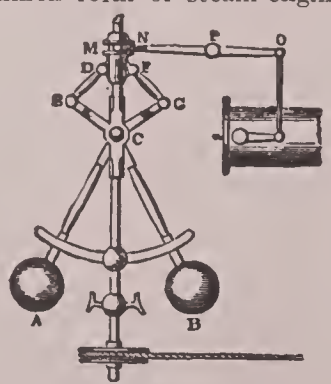
GOV'AN, a town of Scotland, county of Lanark, on the left bank of the Clyde, to the west of Glasgow, of which it forms a suburb. It is the site of extensive ship-building yards, engineering works, dye-works, etc. Pop. of town 82,174.

GOVERNMENT, is a word used in common speech in various significations. It denotes the act of governing, the persons who govern, and the mode or system according to which the sovereign powers of a nation, the legislative, executive, and judicial powers are vested and exercised. See Aristocracy, Democracy, Monarchy, Oligarchy, Republic, Local Government, etc.

GOVERNMENT LAND, all land within the United States the title to which is not in a state or an individual. This includes all land occupied for governmental purposes, as for military or naval posts and stations, public buildings, etc., but the term is popularly used as being synonymous with "public lands." In this sense, only such land, owned by the government, as is unsurveyed and open to sale or occupation under the "homestead laws," is included. Land may be acquired by the government for public use under the power of eminent domain, and property thus acquired would be "government land" in the broadest sense, but not as the term is commonly used, as such lands would not be open to public occupation and pre-emption.

GOVERNOR, the chief executive officer in the states of the American union. He is elected by the people of the state, and his rights and duties are, in general, those usually associated with the head of the executive department in a republican form of government, namely, the appointment of certain classes of officials, the exercise of the pardoning power and the right of veto and the command of the state militia. The term of office and the specific limitations of the governor's powers vary naturally, from state to state, and will be found under the heading Constitution, in the articles on the different states.

GOVERNOR, a contrivance in mills and machinery for maintaining a uniform velocity with a varying resistance. A common form of steam-engine gov-



Governor of a steam-engine.

ernor consists of a pair of balls A B suspended from a vertical shaft kept in motion by the engine. When the engine goes too fast the balls fly farther asunder and depress the end of a lever N P O which partly shuts a throttle-valve, and diminishes the quantity of steam admitted into the cylinder; and on the other hand, when the engine goes too slow, the balls fall down toward the spindle and elevate the valve, thus increasing the quantity of steam admitted into the cylinder. By this ingenious contrivance, therefore, the quantity of steam admitted to the cylinder is exactly proportioned to the resistance of the engine, and the velocity kept constantly the same. A similar contrivance is employed in mills to equalize the motion of the machinery. When any part of the machinery is suddenly stopped, or suddenly set agoing, and the moving power remains the same, an alteration in the velocity of the mill will take place, and it will move faster or slower. The governor is used to remedy this.

GRAAFIAN VESICLES, in anatomy, numerous small globular transparent follicles found in the ovaries of mammals. Each follicle contains one ovum, which is expelled when it reaches maturity. Small at first, and deeply imbedded in the ovary, they gradually approach the surface, and finally burst and discharge the ovum.

GRACCHUS, a Roman family of the Sempronian gens, several members of which have become historical. Tiberius Sempronius Gracchus, a general of the Second Punic war, was consul 215 B.C., defeated Hanno 214 B.C., and was killed 212 B.C.—Another Tiberius Sempronius Gracchus became consul 178 B.C., and again 163 B.C. He married Cornelia, a daughter of Scipio Africanus, and was the father of the two most celebrated Gracchi, Tiberius Sempronius and Caius, the former born about 169 B.C., killed 133 B. C., the latter born 159 B.C., killed 121 B.C. The brothers having lost their father early, received from their mother Cornelia a careful education. At a more advanced age their minds were formed and ennobled by the Greek philosophy. Tiberius early made himself conspicuous in the military service. Under the command of his brother-in-law, the younger Scipio, he served at the siege of Carthage. While he was yet a mere youth he was received into the College of Augurs, an honor usually conferred only upon distinguished statesmen. He was subsequently quæstor to the Consul Mancinus, and was employed in the Numantian war, in which he greatly distinguished himself by the conclusion of a treaty by which he saved the lives of 20,000 men who were entirely at the mercy of the Numantines. In 133 B.C., he offered himself as a candidate for the tribuneship, which office rendered his person inviolable so long as he was invested with it, and placed him in a situation to advance his great plans for the improvement of the condition of the people in a legal way. He was violently opposed by the aristocracy and the tribune Marcus Octavius, whose veto retarded the passage of the bill. Tiberius, however, by exerting all the prerogative of his office, managed to pass his bill, and three commissioners were appointed to carry it into execution, namely, Tiberius himself, his brother Caius, and his father-in law Appius Claudius. He was accused of having violated his office; of aspiring to be king; and at the next election for the tribuneship he was slain, with 300 of his followers, at the entrance to the

Temple of Fides. Ten years after the death of his brother Tiberius, the younger Gracchus obtained the tribuneship. Several popular measures gained him great favor with the people, but the intrigues of the nobles ultimately caused his fall. A tumult, in which a lictor of Opimius was killed, gave the senate a pretense for empowering the consuls to take strong measures. Opimius made an attack upon the supporters of Gracchus with a band of disciplined soldiers. Nearly 3000 were slain, and Gracchus escaped to the grove of the Furies, where he was slain at his own request by a slave, who then killed himself.

GRACE, Days of, in commerce, a certain number of days immediately following the day, specified on the face of a bill or note, on which it becomes due. Till the expiry of these days payment is not necessary. In Britain and America the days of grace are three. Austria (three days) and Russia (ten days) are the only other countries which allow days of grace.

GRACES (Greek, Charities, translated by the Romans Gratiæ), the goddesses of grace, from whom, according to Pindar, comes everything beautiful and agreeable. According to most poets and mythologists they were three in number, the daughters of Zeus and Eurynome, and Hesiod gives them the names of Aglaia (brilliancy), Thalīa (the blooming), and Euphrosynē (mirth). Homer mentions them in the Iliad as handmaids of Hera (Juno), but in the Odyssey as those of Aphroditē (Venus), who is attended by them in the bath, etc. He conceived them as forming a numerous troup of goddesses, whose office it was to render happy the days of the immortals. The three graces are usually represented slightly draped or entirely nude, locked in each other's embraces, or hand in hand.

GRA'DIENT, in roads and railways, a term used to signify the departure of the track from a perfect level, usually expressed as a fraction of the length: thus 1 in 250 signifies a rise or fall of 1 foot in 250 feet measured along the line.

GRADUATION, the art of dividing into the necessary spaces the scales of mathematical, astronomical, and other philosophical instruments. Common graduation is simply effected by copying from a scale prepared by a higher process; original graduation is chiefly performed either by stepping or bisection. Stepping consists in ascertaining by repeated trial with finely-pointed spring dividers—which are made, as it were, to proceed by successive steps—the size of the divisions required, their number being known, and then finally marking them. In bisection the beam compasses are used, an arc with a radius of nearly half the line being described from either end of the line, and the short distance between the arcs bisected with the aid of a magnifier and a fine pointer. The process is repeated, for each of the two halves thus obtained, until by subdivision the required graduation is obtained. Ordinary instruments are graduated by machines, most of which are based upon the principle of that invented by Ramsden in 1766.

GRADY, Henry Woodfen, American journalist, was born at Athens, Ga., in 1851. In 1880 he purchased an interest in and became editor of the Atlanta Constitution. In 1886 he delivered a speech in New York on "The New South," which attracted considerable notice. Mr. Grady was one of the first prominent representatives of the New South to express the willingness of that generation and section to throw in their lot with the rest of the nation. He died in 1889.

GRAFTING, an operation by which a bud or scion of an individual plant is inserted upon another individual, so as to become organically united with the stock on which it has been placed. Grafting can only take place between plants which have a certain affinity, individuals of the same species, genus,

Splice-grafting. Saddle-grafting. Cleft-grafting.

or order. The graft does not become identified with the stock to which it is united, but retains its own peculiarities of variety or species. The parts between which grafting is effected must be actively vegetating. The advantages derived from grafting are the preservation of remarkable varieties, which could not be reproduced from seed; the more rapid multiplication of particular species and the anticipation of the period of fructification, which may thus be advanced by several years. The principal methods of grafting are—1. By approach.—This process is intended to unite at one or more points two plants growing from separate roots. Plates of bark of equal size are removed, the wounds are kept together and protected from air. Stems, branches, or roots may be united in this way. 2. By scions.—Under this head there are a variety of methods, such as whip, splice, cleft, saddle, crown grafting, etc. In whip-grafting or tongue-grafting the stock is cut obliquely across and a slit or very narrow angular incision is made in its center downward across the cut surface, a similar deep incision is made in the scion upward, at a corresponding angle, and, a projecting tongue left, which being inserted in the incision in the stock, they are fastened closely together. Splice-grafting is performed by cutting the ends of the scion and stock completely across in an oblique direction, in such a way that the sections are of the same shape, then laying the oblique surfaces together so that the one exactly fits the other, and securing them by tying or otherwise. In cleft-grafting, the stock is cleft down, and the graft, cut in the shape of a wedge at its lower end, is inserted into the cleft; while, in saddle-grafting, the end of the stock is cut into the form of a wedge, and the base of the scion, slit up or cleft for the purpose, is affixed. Crown-grafting or rind-grafting is performed by cutting the lower end of the scion in a sloping direction, while the head of the stock is cut over horizontally and a slit is made through the inner bark. A piece of wood, bone, ivory, or other such substance, resembling the thinned end of the scion, is inserted in the top of the slit between the alburnum and inner bark and pushed down in order to raise the bark, so that the thin end of the scion may be introduced without being bruised. The edges of the bark on each side are then brought close to the scion, and the whole is bound with matting and a lump of clay put round it. 3. By buds.—This consists in transferring to another stock a plate or bark, to which one or more buds adhere. Bud-grafting is the most commonly practiced, especially for multiplying fruit-trees and roses, owing to the facility with which it may be performed.

GRAIL, the legendary holy vessel, supposed to have been of emerald, from which Christ dispensed the wine at the last supper. It was said to have been brought to England by Joseph of Arimathea, but to have been taken back to heaven until the appearance of heroes worthy to be its guardians. Titurel, a descendant of the Asiatic prince Perillus, whose descendants had allied themselves with the family of a Breton sovereign, was chosen as its keeper. He erected for it a temple on the model of that at Jerusalem, and organized a band of guardians. It was visible only to the baptized and pure of heart. With this legend that of King Arthur became connected. Three of his knights, Galahad, Percival, and Bors, had sight of it, and on the death of Percival, its last guardian, it was again taken to heaven.

GRAIN, includes all those kinds of grass which are cultivated on account of their seeds for the production of meal or flour. All kinds of grain contain in varying quantities the following elements: gluten, fecula or starch, a sweet mucilage, a digestible aromatic substance contained in the hulls, and moisture, which is predominant even in the driest grain, and serves, after planting, to stimulate the first motions of the germ.

GRAIN ELEVATOR. See Elevator.

GRAIN-LEATHER, dressed horse-hides, goat-skins, seal-skins, etc., blacked on the grain side, that is the hair side, for shoes, boots, etc.

GRAIN-MOTH, a minute moth whose larvæ or grubs devour grain in granaries. The moths have narrow, fringed wings, of a satiny luster.

GRAINS OF PARADISE, Guinea grains or Malaguetta pepper, a plant of tropical Western Africa. They are chiefly used in cattle medicines and to give a fiery pungency to cordials. The "Grain Coast" of Africa takes its name from the production of these seeds in that region.

GRALLATO'RES, an order of birds which formerly included the heron, ibis, stork; but these are now put into an-

other order, and the Grallatores, properly so called, consist of the following families, namely, those of the snipe, stint, and ruff; the red-shanks, green-shanks, and sand-pipers; the curlews, phalaropes, stilts, and avocets; the plovers, oyster-catchers, turnstones, lap-

Grallatores—Head and foot of crane.

wings, coursers; the jacanas, the bustards; the rails and coots; and the cranes. They are generally known as wading-birds, as they frequent shores and banks of streams, marshes, etc., and their legs and beak are commonly rather long.

GRAMMAR, in reference to any language, is the system of rules, principles, and facts which must be known in order to speak and write the language correctly. Comparative grammar treats of the laws, customs, and forms which are shown by comparison to be common to various languages; general or universal grammar, of those laws which, by logical deduction, are demonstrated to be common to all. The divisions of grammar vary with the class and also with the method of treatment. In common English grammars the division is generally fourfold: Orthography, which treats of the proper spelling of words, and includes orthoepy, treating of the proper pronunciation; etymology, which treats of their derivations and inflections; syntax, of the laws and forms of construction common to compositions in prose and verse; prosody, of the laws peculiar to verse. Although the systematization of grammar had begun in some sort in Plato's time it was chiefly to the Alexandrian writers that it owed its development. The first Greek grammar for Roman students was that of Dionysius Thrax, in use about 80 B.C. Comparative grammar can only be said to have existed from the beginning of the last century, when the critical study of Sanskrit established the affinities of the languages of the Indo-European group. The names of Bopp, Grimm, Pott, Schleicher, Müller, etc., are especially associated with its development.

GRAMMAR-SCHOOLS, an old name of a class of schools at which a secondary education is given, as a preparation for a university course. The term seems to have arisen from the once almost exclusive occupation of these schools in the teaching of the elements or grammar of the Latin and Greek languages. In England the character of the teaching in secondary schools, where not restricted by endowments, is necessarily influenced by the course of instruction in the universities, in which the classical element still preponderates.

The term Grammar School is now used in the United States to designate the upper grades, ordinarily the fourth to the eighth, inclusive, of the common school, in which not only grammar, but also arithmetic, geography, history, elements of natural science, usually drawing, some form of manual training, and sometimes elementary algebra or geometry, with a foreign language, enter into the curriculum.

GRAMME, the unit of weight in France = 15.4323 grains. A decagramme or ten grammes 5.644 drams; a hectogramme (100 grammes) = 3.527 oz.; a kilogramme (1000 grammes) = 2.205 lbs.; a myriagramme (10,000 grammes) = 22.046 lbs.

GRAMPUS, a name for several marine cetaceous mammals allied to the dolphins, especially those of the Atlantic and North Sea, which grow to the length of 25 feet, and is remarkably thick in proportion to its length. The spout-hole is on the top of the neck. The color of the back is black; the belly is of a snowy whiteness, and on each shoulder is a large white spot: The grampus is carnivorous and remarkably voracious, even attacking the whale.

GRANADA (grȧ-nä'dȧ), a city in the south of Spain, capital of the province of Granada. The streets rise picturesquely above each other, with a number of turrets and gilded cupolas, the whole being crowned by the Alhambra, or palace of the ancient Moorish kings. In the background lies the Sierra de Nevada, covered with snow. Its university was founded about 1530, and is attended by some 1000 students. The city was founded by the Moors before 800, and from 1036 to 1234 was included in the Kingdom of Cordova. In 1235 it became the capital of the Moorish kingdom of Granada, and attained almost matchless splendor. In 1491 it remained the last stronghold of the Moors in Spain, but was taken by the Spaniards under Ferdinand and Isabella in 1492, along with the kingdom having a population of perhaps 500,000. Its prosperity continued almost without diminution till 1610, when the decree expelling the Moors from all parts of Spain told severely upon it, and it has never recovered. Pop. 75,054.—The province, which is partly bounded by the Mediterranean, has an area of 5610 sq. miles. Pop. 478,846.

GRANADA, formerly a Moorish kingdom in Spain, bordering on the Mediterranean, now represented by the three provinces, Granada, Almeria, and Malaga; area, 11,000 sq. miles. In 1492 it passed into the possession of the Spaniards.

GRAN CHACO, El, a territory of the Argentine Republic, lying mainly between the Vermejo, Paranȧ, and Salado. It is inhabited by various Indian tribes, the total Indian population being estimated at from 20,000 to 40,000.

GRAND ARMY OF THE REPUBLIC, shortly after the close of the civil war, Dr. B. F. Stephenson, who had been a surgeon in a volunteer regiment suggested the organization of Union veterans into a national association for mutual assistance. The first post was formed at Decatur, Ill., April 6, 1866. The objects of the order were "to maintain and strengthen the fraternal feelings which bind together the soldiers, sailors and marines who united to suppress the Rebellion; to perpetuate the memory of those who have died and to lend assistance to the needy veterans and their widows and orphans." The "post" is the local organization, the "department" is the state or territorial organization. National annual meetings called encampments are held. On these occasions and in its parades the members wear a dark blue uniform and black slouch hat. The official badge consists of a miniature strap and ribbon showing the national flag from which is hung the brass star of the membership badge. Although in 1869 The Grand Army declared against participation in partisan politics, yet its close organization and the preponderance of republicans in its ranks made it a strong factor in politics and every republican president from Grant to McKinley was a veteran of the civil war and polled practically the entire Grand Army vote. The organization also has influenced pension legislation. Its membership has been dwindling rapidly through deaths and it is now less than 200,000.

GRAND-DUKE, the title of the sovereign of several of the states of Germany, who are considered to be of a rank between duke and king; also applied to members of the imperial family of Russia.

GRANDEE', in Spain a noble of the first rank, which consisted partly of the relatives of the royal house, and partly of such members of the high feudal nobility distinguished for their wealth as had, by the grant of a banner received from the king, the right to enlist soldiers under their own colors.

GRAND JURY. See Jury.

GRAND JURY, the institution of the grand jury dates from the times of the Saxons when it had much the same function as now being present at the opening of each term of court for the purpose of inquiring into the charges of offenses and returning to the court its opinion thereof. Today in America and in England its functions are practically as in the olden days. The charges against the accused are laid before the grand jury and the duties of the members is to inquire whether there is sufficient prima facie evidence to require a trial. For this purpose it may summon witnesses which are usually for the prosecution, the witnesses for the defense not appearing until the prisoner is brought to trial, before the petit jury. If the prima facie evidence is sufficient a bill of indictment is returned. The grand jury also is supposed to inquire into all matters affecting the general conditions of the public weal and often makes investigations of public abuses with recommendations for their reform.

GRAND PRE, a beautiful village on the basin of Minas, King's county, Nova Scotia; the scene of Longfellow's Evangeline. The French settlers there were expelled by Virginian colonists in 1613. Pop. 1600.

GRAND RAPIDS, county seat of Kent co., Michigan, situated on the rapids of the Grand river, 40 miles from its mouth. It is handsomely built, and has a pleasant and healthy situation. It is connected with the railway system of the United States and Canada, and is a

important center for the distribution of pine and hard-wood lumber. It has large manufactures of furniture, wooden ware, agricultural implements, brushes, machinery, etc. Pop. 1909, 114,000.

GRANGE, in the United States, a combination, society, or lodge of farmers for the purpose of promoting the interests of agriculture, more especially for abolishing the restraints and burdens imposed on it by the commercial classes, the railroad and canal companies, etc., and for doing away with middlemen. Granges originated in the great agricultural regions of the Mississippi, and still prevail most generally there.

GRANGERS, the local lodges of the patrons of husbandry organized in 1867 at Washington were called granges and hence the nickname of the secret society. Its object was to aid the farmers by enabling them to co-operate and purchase their supplies at first hand and by offering opportunities for social and intellectual improvement. Lack of business training caused financial reverses in many of the enterprises which were undertaken. Entering politics the association in the middle west threw its support to candidates representing their theories and in 1873 and 1874 carried the legislatures of Illinois and Wisconsin which passed stringent laws directed against "extortion and unjust discrimination in the rates charged for the transportation of passengers and freights." The acts were subsequently repealed when the grangers lost their influence.

GRAN'ILITE, indeterminate granite; granite that contains more than three constituent parts.

GRANIL'LA, the dust or small grains of the cochineal insect.

GRANITE, an unstratified rock, composed generally of the minerals quartz, felspar, and mica, mixed up without regular arrangement of the crystals. The grains vary in size from that of a pin's head to a mass of 2 or 3 feet, but they seldom exceed the size of a large gaming die. When they are of this size or larger, the granite is said to be "coarse-grained." Granite is an igneous or fire-formed rock which has been exposed to great heat and pressure deep down in the earth. It is one of the most abundant of the igneous rocks seen at or near the surface of the earth, and was formerly considered as the foundation rock of the globe, or that upon which all sedimentary rocks repose; but it is now known to belong to the various ages from the Pre-Cambrian to the Tertiary, the Alps of Europe containing granite of the later age. In Alpine situations it presents the appearance of having broken through the more superficial strata; the beds of other rocks in the vicinity rising toward it at increasing angles of elevation as they approach it. It forms some of the most lofty of the mountain chains of the eastern continent, and the central parts of the principal mountain ranges of Scandinavia, the Alps, the Pyrenees, and the Carpathian Mountains are of this rock. Granite supplies the most durable materials for building, as many of the ancient Egyptian monuments testify. It varies much in hardness as well as in color, in accordance with the nature and proportion of its constituent parts, so that there is much room for care and taste in its selection. Granite in which felspar predominates is not well adapted for buildings, as it cracks and crumbles down in a few years. The Aberdeen bluish-gray granite is celebrated for its great durability, and also for its beauty. The Peterhead red granite, the hue of which is due to its felspar being the flesh-colored potash variety called orthoclase, is highly esteemed for polished work, as columns, pillars, graveyard monuments, etc. Granite, in which mica is replaced by hornblende is called syenite; when both mica and hornblende are present it is called syenitic granite; when talc supplants mica it is called protogene, talcose, or chloritic granite; a mixture of quartz and hypersthene, with scattered flakes of mica, is called hypersthenic granite; and the name of graphic granite, or gepmatite, is given to a variety composed of felspar and quartz, with a little white mica, so arranged as to produce an irregular, laminar structure. When a section of this latter mineral is made at right angles to the alternations of the constituent materials, broken lines resembling Hebrew characters present themselves; hence the name. Granite abounds in crystallized earthy minerals; and these occur for the most part in veins traversing the mass of the rock. Of these minerals beryl, garnet, and tourmaline are the most abundant. It is not rich in metallic ores. The oriental basalt, found in rolled masses in the deserts of Egypt, and of which the Egyptians made their statues, is a true granite, its black color being caused by the presence of hornblende and the black shade of the mica. The oriental red ganite chiefly found in Egypt, and of which Pompey's Pillar and Cleopatra's Needles were constructed, is composed of large grains or imperfectly formed crystals of flesh-colored felspar, of transparent quartz, and of black hornblende.

GRANT, in law, a gift in writing of such a thing as cannot be passed or conveyed by word only; thus, a grant is the regular method by the common law of transferring the property of incorporeal hereditaments, or such things whereof no actual delivery of possession can be had.

GRANT, Ulysses S., general and president of the United States, born in 1822 at Point Pleasant, in Clermont co., Ohio. His real name was Hiram Ulysses Grant, the name afterwards used by him having arisen out of an error in the registration of his cadetship. After having studied in the military academy at West Point he served during the Mexican war, taking part in every battle except Buena Vista, and being brevetted captain for gallantry. In 1854 he resigned his commission and engaged first in farming near St. Louis, and then in the leather trade with his father at Galena, Illinois. On the declaration of war in 1861 he was chosen captain of a company of volunteers, and was rapidly promoted to a brigadier-generalship of volunteers. He seized Paducah, commanding the Tennessee and Ohio navigation, checked the departure of reinforcements from Belmont, captured Fort Henry and Fort Donelson, and won the two days' battle of Shiloh. He then gained a new victory at Juka, and after repulsing the confederates before Corinth commenced operations against Vicksburg. After a siege of some months in the course of which he took the town of Jackson, and scattered an army under Johnston, the town surrendered. For this Grant was made major-general in the regular army, and placed in command of the Mississippi division. The battles of Chickamauga and Chattanooga, which followed, opened the way into Georgia for the federal troops. In Feb. 1864, he was appointed lieutenant-general, and assumed command of the armies of the United States. In a succession of hotly-contested battles at the Wilderness, Spottsylvania, North Anna, and Cold Harbor, he steadily advanced

Ulysses S. Grant.

on Petersburg and Richmond. These speedily fell, and Lee, defeated at Five Forks and completely surrounded, surrendered to Grant, April 9, 1865. Grant returned to Washington, and in 1866 was made general of the armies of the United States. After exercising an important influence during the presidency of Johnson, Lincoln's successor, he was himself elected president in 1868. His administration allayed the soreness which still survived from the great struggle between the states, and was also noteworthy for the reduction of the national debt and the settlement of the Alabama dispute with England. He was re-elected in 1872. On his retirement he spent some time in travel. Latterly he became involved in a bubble company which exploited his name and left him heavily in debt. He manfully endeavored to repair his fortune by writing and publishing his Memoirs, and in this he was successful, though suffering greatly from the cancerous disease of which de died in 1885.

GRANULATION, the subdivision of a metal into small pieces or thin films, effected either by pouring the metal in a fine stream or through a sieve into water. It is employed in chemistry to

increase the surface, so as to render the metal more susceptible to the action of reagents, and in metallurgy for the subdivision of a tough metal like copper. Small shot is made by a species of granulation.

GRANULATION, in surgery, the formation of little grain-like fleshy bodies on the surfaces of ulcers and suppurating wounds, serving both for filling up the cavities and bringing nearer together and uniting their sides. The color of healthy granulations is a deep florid red. When livid they are unhealthy, and have only a languid circulation.

GRANVELLA, or **GRANVELLE,** Antoine Perrenot, Cardinal de, minister of state to Charles V. and Philip II. of Spain, was born in 1517 near Besançon. He studied at Padua and at Louvain, in his twenty-third year was appointed Bishop of Arras, and was present at the diets at Worms and Ratisbon. In 1545 he was sent to the Council of Trent, and on the death of his father in 1550 was appointed by Charles V. to succeed him in the office of chancellor. In 1552 he negotiated the Treaty of Passau, and in 1553 arranged the marriage of Don Philip with Mary Queen of England. Under Philip II. he remained chief minister, and in 1559 negotiated the peace of Câteau-Cambrésis. In 1570 Philip sent him to Rome to conclude an alliance with the pope and the Venetians against the Turks, and afterward to Naples as viceroy. In 1575 he was recalled to Spain, and placed at the head of the government with the title of president of the supreme council of Italy and Castile. In 1584 he was created Archbishop of Besançon, and died at Madrid in 1586.

GRANVILLE, Granville George Leveson-Gower, 2d Earl, K. G., English statesman, was born in London in 1815; educated at Eton and Christ Church, Oxford; entered parliament in 1836 for Morpeth, afterward for Lichfield, both in the liberal interest. In 1868 he was colonial secretary under Gladstone, and on the death of Clarendon in 1870 succeeded to the secretaryship of foreign affairs, which he held until 1874. During this period he negotiated the treaty of 1870, guarantecing the independence of Belgium, and "protested" against the Russian repudiation of the Black Sea clause of the treaty of Paris. On the return of Gladstone to office in 1880 Lord Granville again became foregin secretary until Lord Salisbury came into power in 1885. He died in 1891.

GRAPE. See Vine.

GRAPE-SHOT, a kind of shot generally consisting of three tiers of cast iron balls arranged, three in a tier, between four parallel iron discs connected together by a central wrought-iron pin. Case-shot is now more used than grape-shot.

GRAPH'ITE, one of the forms under which carbon occurs in nature, also known under the names of Plumbago, Black-lead, and Wad. It occurs not unfrequently as a mineral production, and is found in great purity at Borrowdale in Cumberland, and in large quantities in Canada, Ceylon, and Bohemia. Graphite may be heated to any extent in close vessels without change; it is exceedingly unchangeable in the air; it has an iron-gray color, metallic luster, and granular texture, and is soft and unctuous to the touch. It is used chiefly in the manufacture of pencils, crucibles, and portable furnaces, in burnishing iron to protect it from rust, for giving a smooth surface to casting moulds, for coating wax or other impressions of objects designed to be electrotyped, and for counteracting friction between the rubbing surfaces of wood or metal in machinery.

GRAPNEL, or **GRAPLING,** a sort of small anchor, fitted with four or five flukes or claws, and commonly used to fasten boats or other small vessels. The name was also given to the grappling-iron formerly used in naval engagements to hold one ship to another.

GRASS-CLOTH, the name of certain beautiful light fabrics made in the East from China grass. None of the plants yielding the fiber are grasses.

GRASSES, a very extensive and important order of endogenous plants, comprising about 250 genera and 4500 species, including many of the most valuable pasture-plants, all those which yield corn, the sugar-cane, the tall and graceful bamboo, etc. The nutritious herbage and farinaceous seed furnished by many of them render them of incalculable importance, while the stems and leaves are useful for various textile and other purposes. The roots are fibrous; the stem or culm is usually cylindrical and jointed, varying in length from a few inches to 80 or 90 feet, as in the bamboo(in the sugar-cane the stem is solid, but porous), and coated with silex; leaves, one to each node or joint, with a sheathing petiole; spikelets terminal, panicled, racemose, or spiked; flowers hermaphrodite or polygamous, destitute of true calyx or corolla, surrounded by a double set of bracts, the outer constituting the glumes, the inner the palcæ; stamens hypogynous, three or six; filaments long and flaccid; anthers versatile; ovary solitary, simple, with two (rarely three) styles, one-celled, with a single ovule; fruit known as a caryopsis, the seed and the pericarp being inseparable from each other. The more important divisions of the natural order of grasses are: the millet, fundi, Guinea grass, the sugar-cane, dhurra, lemon-grass, gama-grass, etc., (maize, Job's tears, canary-grass, foxtail-grass, soft-grass, Timothy grass, rice, feather-grass, (esparto); bent-grass, oats, vernal grass; fescue, meadow-grass, manna-grass, teff, cock's-foot grass, tussac grass, dog's-tail grass; bamboo; wheat, barley, rye, spelt, rye-grass, lyme-grass. In its popular use the term grasses is chiefly applied to the pasture grasses as distinct from the cereals, etc.; but it is also applied to some herbs, which are not in any strict sense grasses at all, e.g. rib-grass, scurvy and whitlow grass. After the culture of herbage and forage plants became an important branch of husbandry, it became customary to call the clovers, trefoils, sainfoin, and other flowering plants growns as fodder, artificial grasses by way of distinction from the grasses proper, which were termed natural grasses. Of the pasture grasses, some thrive in meadows, others in marshes, on upland fields, or on bleak hills, and they by no means grow indiscriminately.

GRASS'HOPPER, the name of various leaping insects nearly akin to the locusts. They are characterized by very long and slender legs, the thighs of the hinder legs being large and adapted for leaping, by large and delicate wings, and by the wing-covers extending far beyond the extremity of the abdomen. Grasshoppers form an extensive group of insects, and are distinguished by the power which they possess of leaping to a considerable distance, and by the stridulous chirping noise the males produce by rubbing their wing-covers together. They are generally of a greenish color.

GRASS-OIL, Oil of Geranium, or Oil of Spikenard, a fragrant volatile oil, used chiefly in perfumery, and obtained from Indian grasses.

GRASS-TREE, the popular name of a genus of Australian plants, having shrubby stems with tufts of long grass-like wiry foliage, from the center of which arise the tall flower-stalks, which

Grass-tree.

sometimes reach the height of 15 or 20 feet, and bear dense cylindrical spikes of blossoms at their summit. The base of the leaves forms, when roasted, an agreeable article of diet, and the leaves themselves are used as fodder for all kinds of cattle. A resin, known in commerce as akaroid resin, is obtained from all the species, which are also popularly known as black-boys.

GRATTAN, Henry, Irish orator and statesman, born at Dublin, in 1746, called to the Irish bar in 1772, and in

Henry Grattan.

1775 elected member for Charlton in the parliament of Ireland. In 1780 he moved resolutions asserting the crown to be the only link between Britain and Ireland, and in 1782 led the volunteer movement, which was instrumental in securing the concession of independen

to Ireland. In 1800 he came forward as member for Wicklow to oppose the union, and on the passage of Pitt's measure was returned to the imperial parliament in 1805 for Malton in Yorkshire, and in 1806 for Dublin. He supported the war policy of the administration, but was latterly chiefly occupied in promoting catholic emancipation. He died in 1820, and was interred in Westminster Abbey.

GRATZ, or **GRAZ,** a town of Austria, capital of Styria, picturesquely situated on the Mur, 90 miles south-west of Vienna. The older town on the left bank, is connected with the suburbs Lend and Gries, on the right by several bridges, besides a railway bridge. The Schlossberg rises 400 feet above the river, but the fortifications of the town have given place to avenues and pleasure grounds. The manufactures consist of woolens, cotton, and silk tissues, machinery, steel, rails, wagons, soap, leather, ironware, etc. Pop. 138,370.

GRAVEL, in pathology, small concretions or calculi in the kidneys or bladder.

GRAVING, the act of cleaning and repairing a ship's bottom. At seaports this is usually done in a dry-dock called a graving-dock. See Docks.

GRAVITATION, the force by reason of which all the bodies and particles of matter in the universe tend toward one another. According to the law of gravitation discovered by Newton, every portion of matter attracts every other portion with a force directly proportional to the product of the two masses, and inversely proportional to the square of the distance between them. Kepler had given the laws, deduced from observation, according to which the planets describe their orbits. From these Newton deduced the laws of the force in the case of planets; and subsequently he generalized the statement of them, by showing the identity of the nature of the force that retains the moon in her orbit, with that which attracts matter near to the surface of the earth. The application of the grand law that he had discovered subsequently occupied a large part of the mathematical labors of Newton. Attacking the problem of lunar inequalities, he accounted for them by considering the perturbations due to the attraction of various bodies of the solar system; and by accounting for all the observed perturbations by means of his newly-discovered law he confirmed the truth of the law itself in such a way as to put it beyond all question. The computation of these various attractions has reached such a degree of accuracy in the hands of mathematicians since Newton, that the most complicated motions of the heavenly bodies can be predicted. The law has also been applied successfully in weighing the planets, explaining the paths of comets, the motions of the tidal wave, etc. It has also been demonstrated to hold good in the case of comparatively small bodies. Thus Maskelyn determined the attraction of a particular mountain, and Cavendish and Bailly measured the attractions of a ball of lead on light finely-balanced bodies, and thus determined the mean density of the earth.

GRAVITY, the term applied to the force with which the earth attracts every particle of matter. The force of gravity is least at the equator, and gradually increases as we recede toward the poles. Thus a given mass, if tested by means of a spring-balance of sufficient delicacy, would appear to weigh least at the equator, and would seem to get heavier and heavier as the latitude increases. This is due to two causes: first, the centrifugal force at the equator is greater than that in high latitudes because of the greater radius of the circle described at that place; and, second, the attraction is diminished by the greater distance of objects on the surface from the earth's center. From both causes combined a body which weighs 194 lbs. at the equator would weigh 195 lbs. at either pole. Experiments to determine the force of gravity from point to point are made by determining the length of a pendulum that beats seconds at each place. By experiments made by Captain Kater at Leith Fort it was found that the force of gravity at that place is such that a body, unresisted by air or otherwise, would acquire in one second, under its influence, a velocity of 32.207 feet per second. At Greenwich the acceleration is 32.1912 feet.

GRAVITY, Specific. See Specific Gravity.

GRAY, Asa, American botanist, born 1810. He was appointed Fisher professor of natural history in Harvard university in 1842, and held the chair till 1873, when he retired from its more active duties. His death took place in 1888. His works include Elements of Botany (1836), A Manual of Botany (1848), and other botanical text-books; also portions of works on the flora of North America and the Genera Boreali-Americana, a Free Examination of Darwin's Treatise (1861), a volume entitled Darwiniana (1876), etc.

GRAY, Elisha, American inventor, born in 1835 at Barnesville, in Ohio. In 1867 he obtained his first patent, which was for telegraphic apparatus. Subsequently, he received nearly fifty patents, relating principally to the telephone and other electrical apparatus. Claims were advanced in behalf of Gray as one of the inventors of the speaking telephone, for which he filed specifications, February 14, 1876; but the patent was awarded to Alexander Graham Bell, whose rights were sustained by the supreme court. Among his other inventions were a system of multiplex telegraphy, a type-printing telegraph, the telautograph, and numerous telegraphic and telephonic appliances and adjuncts. He was for a number of years engaged in the manufacture of telegraphic apparatus in Chicago and Cleveland. He died in 1901.

GRAY, Thomas, English poet, born in London in 1716; educated at Eton with Horace Walpole, and at Cambridge. In 1747 his Ode on a Distant Prospect of Eton College appeared, and in 1751 his Elegy Written in a Country Churchyard, which went through four editions in two months. In 1757 he declined the laureateship, and the same year published his odes, On the Progress of Poesy, and The Bard. He died in 1771, and was buried at Stoke Pogis, Buckinghamshire.

GRAY-LAG, a popular name for the

Gray-lag.

common wild goose. See Goose.

GRAYLING, a genus of fishes. The common grayling is found in many English streams, and also in some in

Grayling.

Scotland. It is scattered over Europe from Lapland to North Italy, and also over part of Asia.

GREAT BAHAMA. See Bahama.

GREAT BRITAIN. See the articles Britain, England, Scotland, and Wales.

GREAT CIRCLE SAILING, or **TANGENT SAILING,** a method of navigating a vessel according to which her course is always kept as nearly as possible on a great circle of the sphere, that is a circle which has for its center the center of the sphere. An arc of such a circle joining two places gives the shortest distance between them, consequently the course of a vessel sailing on this arc will be the shortest possible. A simple instrument called a spherograph is employed for finding the great circle course between places, and this is accompanied by tables compiled for the same purpose.

GREAT EASTERN, an iron steamship, the largest vessel of her time, built (1854–58) at Millwall, on the Thames; length, 680 feet; breadth, 82½, or, including paddle-boxes, 118 feet; height, 58 feet (70 to top of bulwarks). She had six masts, five of iron and one of wood, and could spread 7000 yards of sail, besides having eight engines, divided between her screws and paddles, and capable of working at 11,000 horse-power. From the first her career was unfortunate, the launching process alone lasting three months and costing $300,000. After several unremunerative trips to New York she was employed first as a troopship, and then as a cable-laying ship for which her size and steadiness specially qualified her. Various attempts were afterward made to utilize her, but she at last came to be a mere holiday spectacle, and was broken up in 1888.

GREAT FALLS, a city and port of entry; county seat of Cascade co., Mont., at the junction of the Sun and Missouri rivers, near the falls of Missouri, and on the G. F. and Canada, the Gt.

Northern, and several branch railways. It is in an agricultural region, and near by are rich mines of gold, copper, silver, lead, ore, and coal, and quarries of sandstone. Pop. 17,430.

GREAT LAKES, comprising lakes Superior, Michigan, Huron, Saint Clair, Erie, and Ontario. They lie on the frontier of the United States and Canada and are drained by the Saint Lawrence river into the Atlantic. Their aggregate area is over 90,000 sq. miles, exceeding that of any other series of fresh-water lakes in the world. Lake Superior, the largest, has an area of about 31,000 sq. miles. The Great Lakes occupy depressions that are only slightly defined from the drainage system of the Mississippi and from the depression of Hudson Bay. Their elevation ranges from about 600 feet in Lake Superior to 250 feet in Lake Ontario, but from Lake Superior to Lake Erie the fall is less than 30 feet, so that almost the entire descent is accomplished in the Niagara and Saint Lawrence rivers. The Great Lakes exercise a very beneficial influence upon the climate of the country, particularly by moderating the temperature. This explains the extensive development of fruit culture in part of the Great Lake region, notably in the vicinity of Lake Erie.

The magnitude and importance of transportation upon the Great Lakes are not generally realized. More than one-half of the number of vessels registered in the United States are found upon the Great Lakes. A greater tonnage annually passes through the Detroit river than that which enters and clears in the foreign trade of the Atlantic and Pacific coast ports. No other artificial channel equals the canal at Saint Mary's Falls in the amount of traffic which annually goes through it, the tonnage even exceeding that of the Suez Canal With respect to rapidity, economy, and efficiency, the lake traffic excels that of the ocean. The greatest significance of the lakes is due to their relation to the mining of iron ore and the manufacture of iron products. Viewed in this light, lake transportation is found to be the key to the modern industrial progress and supremacy of the United States. It is generally admitted that but for the cheapness of the lake transportation the iron ore resources of the Lake Superior region would have been scarcely exploited. Without the supply of iron ore many vast industries could not have thrived.

There are numerous harbors along the coast line of the lakes. Many of these havens are shallow, and constant dredging is required to keep them accessible. The national government has expended large sums on harbor improvements. In late years there has been a serious lowering in the level of the lakes' surface, to the great detriment of the harbors. Different plans have been projected for preventing further harm in this respect. Dams have been constructed across the exit channels of the lakes. One of the most serious advantages with which the lake commerce has to contend is the winter ice, which stops all traffic. The cessation of general lake traffic begins about the first of December and continues four or five months, about 222 days being the average annual time during which the canals are open. Much has recently been done to continue the period of traffic by the construction of boats with special provisions for ice crushing. A railroad ferryboat has also been constructed which is able to crush its way through three feet of ice.

The Great Lakes are valuable for their fisheries. Nearly $4,500,000 of fish is taken from them annually, considerably over half by American fishermen.

GREAT SALT LAKE, a lake in the state of Utah, 4000 feet above sea-level, 70 miles in length north to south and 48 miles east to west. Five gallons of its water yield, by evaporation, 14 pints of salt. It has several islands, which, with its shores, are whitened by the salt; and it receives the Bear, the Utah, and several other streams. It contains no fish, but has several species of insects and a crustacean, and is frequented by immense flocks of gulls, ducks, geese, and swans.

GREBE, the common name of the birds characterized by a straight conical bill, no tail, tarsus short, toes flattened, separate, but broadly fringed at their edges by a firm membrane, and

Horned grebe.

legs set so far back that on land the grebe assumes the upright position of the penguin. The geographical distribution is very wide, these birds haunting seas as well as ponds and rivers. They are excellent swimmers and divers; feed on small fishes, frogs, crustaceans, and insects; and their nests, formed of a large quantity of grass, etc., are generally placed among reeds and sedges, and rise and fall with the water.

GREECE, a country, now a kingdom, of Southeastern Europe, the earliest portion of this continent to attain a high degree of civilization, and to produce works of art and literature as yet unsurpassed. It forms the southern extremity of what is called the Balkan Peninsula, and itself partly consists of a well-marked peninsula, the Morea or Peloponnesus, united to Northern Greece by the Isthmus of Corinth. The name Greece (Latin, Græcia) is of Roman origin, the native name for the country being Hellas, and the people calling themselves Hellēnes. Anciently Hellas was used in a wider sense, so as to include both Greece itself and all countries that had become Greek by colonization. Modern Greece is separated from Turkey on the north by a winding, mostly artificial, boundary extending from the Gulf of Arta on the west to the Gulf of Salonica on the east, and comprising rather less than ancient Greece, which also took in part of what is now Albania. Ancient Greece was divided into a number of independent states or territories, namely, in Northern Greece, Thessaly, Epirus (not in the modern kingdom), Locris, Phocis, Bœotia, Œtolia, Acarnania, Attica, Megaris; in the Peloponnesus, Corinth, Argolis, Achaia, Elis, Messenia, Laconia (Sparta), and Arcadia the last entirely inland These names are still kept up, but the country is now divided into nomes, or nomarchies, some of which are formed of the Greek islands, namely, Eubæa, Corfu, Cephalonia, Zante, and the Cyclades. The total area is 25,014 sq. miles; the pop. 2,433,806.

Greece proper is remarkable for the extent of its coast-line, formed by numerous gulfs which penetrate into it in all directions. The largest, the Corinthian Gulf, or Gulf of Lepanto, on the east, and the Saronic Gulf, or Gulf of Ægina, on the west, which nearly meet at the Isthmus of Corinth, separate Northern Greece from the Morea. Another striking feature is the mountainous character of the interior. The rock most largely developed in the mountains of Greece is limestone, which often assumes the form of the finest marble. Granite occurs in patches.

The climate is generally mild, in the parts exposed to the sea equable and genial, but in the mountainous regions of the interior sometimes very cold. In ancient times, when the country was more thickly peopled and better cultivated, the climate seems to have been better.

Greece is mainly an agricultural country, though agriculture is in a somewhat backward state. The land is largely held by peasant proprietors. The principal crops are wheat, barley, and corn. The cultivated land produces all the fruits of the latitude—figs, almonds, dates, oranges, citrons, melons, etc. The vine also grows vigorously, as it did in ancient Greece. But a much more important produce of Greece, especially on the coasts of the Peloponnesus, and in the islands of Cephalonia, Zante, Ithaca, and Santa Maura, is the Corinthian grape or currant. The olive is also largely grown as in ancient times. The domestic animals are neither numerous nor of good breeds. Asses are almost the only beasts of burden employed; and dairy produce is obtained from the sheep and the goat.

The manufactures are extremely limited, but with all other branches of industry in Greece are increasing. They include cottons, woolens, earthenware, leather, etc.; and ship-building is carried on largely at various points of the coast, and at the Piræus. The greatest hindrance to the development of Greece at the present time is the want of good roads, but this is being gradually remedied. The money unit of Greece is the drachma of 100 lepta, which is nominally 1 franc.

According to the present constitution the throne is hereditary in the family of King George (second son of the King of Denmark). The legislative authority is vested in a single chamber, called the Boulē, the members of which (proportioned in number to the amount of the population) are elected for four years, ballot by manhood suffrage. The executive power rests with the king and ministry. The Greek Church alone is established, but all forms of religion enjoy toleration. Justice is administered, on

GREECE

the basis of the French civil code. Greece has a large public debt, an estimated total being $115,000,000. All able-bodied males are liable to military service from the age of 21, the periods being two years in the active army, ten in the reserve, eight in the national guard, and ten in the national guard reserve. In 1900 the total nominal strength of the army was 25,333. The navy consisted of five ironclads (three of them of some fighting power), and a number of other vessels. Several vessels are being added.

The ancient Greeks were an Aryan race, probably most closely akin to the Italian peoples. They were noted for physical beauty and intellectual gifts. The present population contains a considerable intermixture of foreign stocks, among which the Albanese, or Arnauts, are the most numerous; but the great majority, though not without some taint in their blood, are of Greek extraction. While the population of Greece proper is not more than 2,400,000, the whole Greek nationality reaches nearly 8,000,000, of whom 3,500,000 are found in European Turkey and 2,000,000 in Asia Minor. Education in Greece is free and compulsory in theory (from the age of five to twelve), but a large proportion of the people can neither read nor write. The national dress of the Greeks resembles the Albanian costume. In the men it consists of a tight jacket, generally scarlet, wide trousers descending as far as the knee, and embroidered gaiters; in the women it consists of a vest fitting close to the shape, and a gown flowing loosely behind.

The earliest inhabitants of Greece were the Pelasgians, of whom little or nothing is known with certainty. The Pelasgians were succeeded by the Hellenes, or Greeks proper, who may have been simply one of the Pelasgian tribes or races. To the early period of the Hellenic occupation of Greece belong the legends of the Trojan War, of Theseus, of Jason and the Argonauts, etc. The Hellenes were divided into four chief tribes—the Æolians, occupying the northern parts of Greece (Thessaly, Bœotia, etc.); the Dorians, occupying originally a small region in the neighborhood of Mount Œta; the Achæans, occupying the greater part of the Peloponnesus; and the Ionians, occupying the northern strip of the Peloponnesus and Attica. Of the four principal tribes the Ionians were most influential in the development of Greece. The distribution of the Hellenic tribes was greatly altered by the Dorian migration, sometimes called "the return of the Heracleidæ" (descendants of Hercules), placed by Thucydides about eighty years after the fall of Troy or about B.C. 1104, according to the ordinary chronology.

In course of time many Greek settlements were made on the coasts of the Hellespont, the Propontis (Sea of Marmora), and the Black Sea, the most important being Byzantium (Constantinople), Sinope, Cerasus, and Trapezus (Trebizonde). There were also flourishing Greek colonies on the coasts of Thrace and Macedonia; for example, Abdera, Amphipolis, Olynthus, Potidæa, etc.; and the Greek colonies in Lower Italy were so numerous that the inhabitants of the interior spoke Greek, and the whole region received the name of Greater Greece (Magna Græcia).

Although ancient Greece never formed a single state, the various Greek tribes always looked upon themselves as one people, and classed all other nations as barbaroi (foreigners). There were four chief bonds of union between the Greek tribes. First and chiefly they had a common language, which, despite its dialectic peculiarities, was understood throughout all Hellas or the Greek world. Secondly, they had common religious ideas and institutions, and especially, in the oracle of Delphi, a common religious sanctuary. Thirdly, there was a general assembly, of the Greeks, the amphictyonic league, in which the whole people was represented by tribes (not by states), and the chief functions of which were to guard the interests of the sanctuary of Delphi, and to see that the wars between the separate states of Greece were not too merciless. The fourth bond consisted in the four great national festivals or games, the Olympian, Isthmian, Nemean, and Pythian, on the first of which the whole of Greece based its calendar.

The various separate states of Greece may be divided, according to the form of their constitution, into the two great classes of aristocratic and democratic. Sparta or Lacedæmon, the chief town of Laconia and of the Doric tribe, was the leading aristocratic state; and Athens, the capital of Attica and the chief town of the Ionic tribe, was the leading democratic state; and as a rule all the Doric states, and subsequently all those under the influence of Sparta, resembled that city in their constitution; and all the Ionic states, and those under the influence of Athens, resembled it. These two tribes or races are the only ones that come into prominence during the earlier part of Greek history subsequent to the Doric migration. Sparta is said to have derived its form of government, and all its institutions, in the 9th century B.C., from Lycurgus, whose regulations developed a hardy and warlike spirit among the people, the results of which were seen in their conquests over surrounding states, especially over the Messenians in the 8th and 7th centuries B.C.

The constitution of Athens appears from the legends of Theseus and Codrus to have been at first monarchical, and afterward aristocratic, and to have first received a more or less democratic character from Solon at the beginning of the sixth century B.C. This was followed about fifty years later by a monarchical usurpation under Pisistratus, and his sons Hippias and Hipparchus, the last survivor of whom, Hippias reigned in Athens till 510 B.C. After the expulsion of Hippias the republic was restored, under the leadership of Cleisthenes, in a more purely democratic form than at first. A brief struggle with the Spartans, whose aid was invoked by some of the nobles, now took place, and Athens emerged from it well prepared for the new danger which threatened Greece.

The Greek colonies in Asia Minor and the adjacent islands, after being conquered by Crœsus, king of Lydia, fell with the fall of Crœsus into the power of Cyrus, king of Persia. In B.C. 500, however, the Ionians revolted with the assistance of the Athenians and Eretrians, and pillaged and burned Sardis. The rebellion was soon crushed by Darius, who destroyed Miletus, and prepared to invade Greece. In 492 he sent an expedition against the Greeks under his son-in-law Mardonius, but the fleet which carried his army was destroyed in a storm off Mount Athos. A second army, under the command of Datis and Artaphernes, landed on Eubœa, and after destroying Eretria, crossed the Euripus into Attica; but it was totally defeated in B.C. 490 on the plain of Marathon by 10,000 Athenians and 1000 Platæans, under Miltiades. In the midst of preparations for a third expedition Darius died, leaving his plans to be carried out by his son Xerxes, who, with an army of 1,700,000 men, crossed the Hellespont in 481 by means of two bridges of boats, and marched through Thrace, Macedonia, and Thessaly, while his fleet followed the line of coast. In the pass of Thermopylæ he was held in check by Leonidas with 300 Spartans and 700 Thespians; but the small band was betrayed and annihilated (480 B.C.); and the way through Phocis and Bœotia being now open he advanced into Attica, and laid Athens in ruins. The deliverance of Greece was chiefly due to the genius and courage of Themistocles. The united fleet of the Greeks had already contended with success against that of the Persians off Artemisium, and had then sailed into the Saronic Gulf, followed by the enemy. Themistocles succeeded in inducing the Persians to attack in the narrow strait between Attica and Salamis, and totally defeated them.

The brilliant part taken by the Athenians under Themistocles in repelling this invasion of Athens greatly increased her influence throughout Greece. From this date begins the period of the leadership or hegemony of Athens in Greece, which continued to the close of the Peloponnesian war, 404 B.C. The first thing which Athens exerted her influence to effect was the formation of a confederacy, including the Greek islands and maritime towns, to supply means for the continuance of the war by payments into a common treasury established on the island of Delos, and by furnishing ships. In this way Athens gradually increased her power so much that she was able to render tributary several of the islands and smaller maritime states. In 469 B.C. the series of victories won by the Athenians over the Persians was crowned by the double victory of Cimon over the Persian fleet and army on the Eurymedon, in Asia Minor, followed by the Peace of Cimon, which secured the independence of all Greek towns and islands. Shortly after followed the brilliant administration of Pericles, during which Athens reached the height of her grandeur.

The position of Athens, however, and the arrogance and severity with which

she treated the states that came under her power made her many enemies. In the course of time two hostile confederacies were formed in Greece, one consisting of Athens and the democratic states of Greece; the other of Sparta and the aristocratic states. At last, in 431, it was declared by Sparta on the complaint of Corinth that Athens had furnished assistance to Corcyra in its war against the mother city; and on that of Megara, that the Megarean ships and merchandise were excluded from all the ports and markets of Attica; and thus began the Peloponnesian war which for twenty-seven years devastated Greece.

The period which follows the fall of Athens is that of Sparta's leadership or hegemony in Greece, which lasted till the battle of Leuctra, in 371 B.C. The Spartan rule was not more liked than that of Athens, and the character of the Spartan state itself, with its increase of wealth and power, underwent great change.

Philip, the father of Alexander the Great, became king of Macedonia, and after the Locrian war (339–338) acquired a firm hold in Greece. He then collected an army for the invasion and conquest of the rotten empire of Persia, and got himself declared commander-in-chief by the amphictyonic league at Corinth in 337 B.C.; but before he was able to start he was assassinated, B.C. 336.

The design of Philip was taken up and carried out by his son Alexander the Great, during whose absence Antipater was left behind as governor of Macedonia and Greece. Soon after the departure of Alexander, Agis III. of Sparta headed a rising against Antipater but was defeated at Megalopolis in 330 B.C., and no other attempt was made by the Greeks to recover their liberty for nearly a hundred years. At the close of the wars which followed the death of Alexander, and which resulted in the division of his empire, Greece remained with Macedonia.

In the course of the first half of the third century B.C. several of the Achæan towns expelled the Macedonians, and revived an ancient confederacy, which was now known as the Archæan League. The league was at first worsted, and was only finally successful when Aratus sacrificed the ultimate end of the league by calling in the aid of the Macedonians.

About this time the Romans, who had just come out victorious from a second war with Carthage, found occasion to interfere in the affairs of Greece. Philip V. of Macedon having allied himself with Hannibal, the Romans sent over Flamininus to punish him, and in this war with Philip the Romans were joined by the Achæan League. Philip was defeated at Cynoscephalæ in 197 B.C., and was obliged to recognize the independence of Greece. The Achæan League thus became supreme in Greece, having been joined by all the states of the Peloponnesus. But the league itself was in reality subject to Rome, which found constant ground for interference until 147 B.C., when the league openly resisted the demand of the senate, that Sparta, Corinth, Argos, and other cities, should be separated from it. In the war which ensued, which was concluded in 146 B.C. by the capture of Corinth by the Roman consul Mummius, Greece completely lost its independence, and was subsequently formed into a Roman province.

On the division of the Roman Empire Greece fell of course to the eastern or Byzantine half. From 1204 to 1261 it formed a part of the Latin Empire of the East, and was divided into a number of feudal principalities. In the latter year it was reannexed to the Byzantine Empire, with which it remained till it was conquered by the Turks between 1460 and 1473. In 1699 the Morea was ceded to the Venetians, but was recovered by the Turks in 1715. From 1715 till 1821 the Greeks were without intermission subject to the domination of the Turks. The rising of the Greeks took place on the 6th of March, under Alexander Ypsilanti, and on the 1st of January, 1822, they published a declaration of independence. In the same year Ali was assassinated by the Turks, but the Greeks, encouraged by most of the European nations, continued the struggle under various leaders, of whom the chief were Marco Bozzaris, Capo d' Istria, Constantine Kanaris, Kolocotroni, etc. On the 3d of February, 1830, a protocol of the allied powers declared the independence of Greece, which was recognized by the Porte on the 25th April of this year. The crown was offered to Leopold, prince of Saxe-Coburg, and when he refused it, to Otho, a young prince of Bavaria, who was proclaimed king of the Hellenes at Nauplia in 1832. But his arbitrary measures, and the preponderance which he gave to Germans in the government, made him unpopular and although after a rebellion in 1843 a constitution was drawn up, he was compelled by another rebellion in 1862 to abdicate. A provisional government was then set up at Athens, and the national assembly offered the vacant throne in succession to Prince Alfred of England and Prince William George of Denmark. The latter accepted it, and on March 30, 1863, was proclaimed as King George I. In 1864 the Ionian Islands, which had hitherto formed an independent republic under the protection of Britain, were annexed to Greece.

In 1897 an insurrection in Crete led to the interference of the Greeks and to war with Turkey, the result being the speedy defeat of Greece, entailing the payment of a heavy war indemnity with some loss of territory on the Tessalian frontier.

The religion of the ancient Greeks was polytheism, there being a great number of divinities, many of whom must be regarded as personifications of natural powers, or of phenomena of the external world, personified sentiments, etc. Thus there were gods corresponding to Earth and Heaven, the Ocean, Night, etc. The Romans, when they became acquainted with the literature and religion of the Greeks, identified the Greek deities with those of their own pantheon. In this way the Greek and Roman deities came to be confounded together, and the names of the latter even came to supersede those of the former. The supreme ruler among the gods was Zeus (Roman Jupiter or Juppiter), the son of Krones (Roman Saturn), who after the subjugation of the Titans and Giants ruled in Olympus, while his brother Pluto reigned over the lower world (Hades, Tartarus), and Poseidōn (Neptune) ruled in the sea. Like reverence was paid to Hēra (Juno), the sister and wife of Zeus, and the queen of Heaven; to the virgin Pallas Athēnē (Minerva); to the two children of (Lētonā), namely, Apollo, the leader of the Muses, and his sister the huntress Artĕmis (Diana), the goddess of the moon; to the beautiful daughter of Zeus, Aphrodītē (Venus), the goddess of love; to Arēs (Mars), the god of war, Hermēs (Mercury), the herald of the gods, and others besides. In addition to these there was an innumerable host of inferior deities (Nymphs, Nereids, Tritons, Sirens, Dryads and Hamadryads, etc.) who presided over woods and mountains, fields and meadows, rivers and lakes, the seasons, etc. There was also a race of heroes or demigods (such as Heracles or Hercules, Perseus etc.) tracing their origin from Zeus, and forming a connecting link between gods and men, while on the other hand the Satyrs formed a connecting link between the race of men and the lower animals.

The true teachers of the Greek religion were the poets and other writers, and it is to the hymns, epics, dramas, and histories of the Greeks that we must turn in order to learn how they regarded the gods. No degree of consistency is to be found in them, however, the personality and local origin of the writers largely moulding their views. In their general attitude toward men the gods appears as inspired by a feeling of envy or jealousy. Hence they had constantly to be appeased, and their favor won by sacrifices and offerings. The Greeks appear to have had at all times some belief in a future existence, but in the earliest times this belief was far from being clearly defined.

The Greek language belongs to the Indo-European group, and is thus a sister of the Sanskrit, Latin, Teutonic and Celtic tongues. It is customary to distinguish three leading dialects according to the three leading branches of the Greeks, the Æolic, the Doric, and the Ionic, to which was afterward added the mixed Attic dialect; besides these there are several secondary dialects. Akin to the Ionic is the co-called Epic dialect, that in which the poems of Homer and Hesiod are written, and which was afterwards adopted by other Epic writers. The Doric was hard and harsh; the Ionic was the softest. In each of these dialects there are celebrated authors. The Ionian dialect is found pure in Herodotus and Hippocrates. The Doric is used in the poem of Pindar, Theocritus, Bion, and Moschus. In Æolic we have fragments of Alcæus and Sappho. After Athens had obtained the supremacy of Greece, and rendered itself the center of all literary cultivation, the master-pieces of Æschylus, Sophocles, Euripides, Aristophanes, Thucydides, Xenophon, Plato, Aristotle, Isocrates, Demosthenes, etc.,

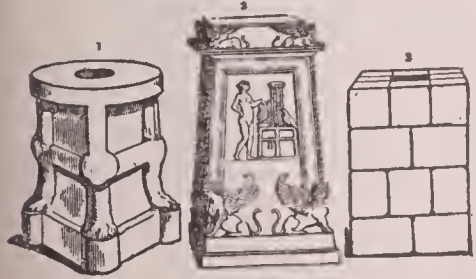
made the Attic the common dialect of literature.

At what time this language first began to be expressed in writing has long been a subject of doubt. According to the usual account of Cadmus the Phœnicians introduced the alphabet into Greece; and it is an undoubted fact that the most of the Greek letters are derived from the Phœnician ones. The Greek alphabet possesses the following twenty-four letters:

—A, α (alpha), *a*; B, β (beta), *b*; Γ, γ (gamma), *g*; Δ, δ (delta), *d*; E, ε (epsilon), *ĕ*; Z, ζ (zeta), *z*; H, η (eta), *ē*; Θ, θ, ϑ (theta), *th*; I, ι (iota), *i*; K, κ (kappa), *k*; Λ, λ (lambda), *l*; M, μ (mu), *m*; N, ν (nu), *n*; Ξ, ξ (xi), *x*; O, ο (omicron, *i.e.* small *o*), *ŏ*; Π, π (pi), *p*; P, ρ (rho), *r*; Σ, σ, ς (sigma), *s*; T, τ (tau), *t*; Υ, υ (upsilon), *u*, commonly transliterated by *y*; Φ, φ (phi), *ph*; X, χ (chi), *ch* guttural (as in Scotch *loch*); Ψ, ψ (psi), *ps*; Ω, ω (omega, or great *o*), *ō*. The alphabet originally introduced into Greece is said to have consisted of but sixteen letters; Θ Ξ Φ X Z H Ψ Ω being of later introduction.

Modern Greek, as spoken by the uneducated classes, is called Romaic, from the fact that those who speak it considered themselves before the descent of the Turks upon Europe as belonging to the Roman Empire, and hence called themselves Romaioi, or Romans. The Greek of the educated classes, that used in the newspapers and other literature of the present day, is distinguished from it by a greater resemblance to the Greek of antiquity, which renders it easy for any one who has a satisfactory acquaintance with ancient Greek to read the modern literary Greek.

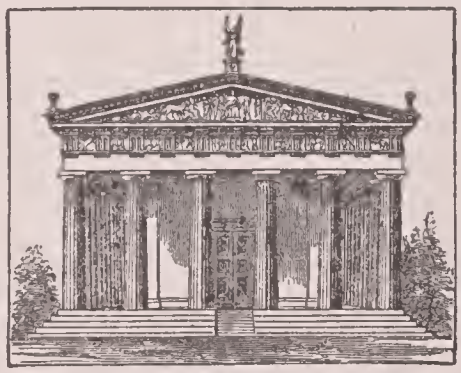
The commencement of extant Greek literature is to be found in the two epic poems attributed to Homer, the Iliad and the Odyssey, which it is commonly believed took shape on the Ionian coast or its islands somewhere between 950 and 850 B.C., and came thence to Greece proper (but see Homer). The former deals directly with the Trojan war, the latter describes the wanderings of Ulysses in returning from it. In European Greece there appeared about the middle of the 9th century, at Ascra in Bœotia, the poet Hesiod, who stood at the head of another epic school. Of the sixteen works attributed to him there have come down to us the Theogony or Origin of the Gods, the Shield of Heracles (a fragment of a larger poem of late authorship), and, most important of all, the Works and Days, a didactic work on agriculture. The works of Homer and Hesiod constituted in a certain degree the foundation of youthful education among the Greeks. Two principal schools may be distinguished, the Æolian and the Dorian. To the former belong Alcæus (611–580), Sappho (610), and Anacreon (530), though the works which now bear Anacreon's name are spurious. In the Dorian school the chief was undoubtedly Pindar (522–443). About this time began a new literary development, that of the drama. The performance at first, however, was merely a sort of oratorio or choral entertainment, until Æschylus (525–456) introduced a second actor, and subordinated choral song to dialogue. A third and even a fourth actor was added by Sophocles (495–405 B.C.), who supplemented the heroic tragedy of Æschylus with the tragedy of human character and the fundamental passions. Euripides (480–406) brought new qualities of picturesqueness, homeliness, and pathos with a less rigid artistic method, and formed a fitting third in the great tragic triad. With this rapid growth of tragedy there was a corresponding development of comedy which assumed an artistic form about 470 B.C. The names of Cratinus (448) and Eupolis (430) are overshadowed by that of Aristophanes (448–385), who for nearly forty years was the burlesque commentator upon the life of the period.



Altars—1, Assyrian, 2, Grecian. 3, Roman.

Thucydides (471–400?) was the founder of philosophic history, and Xenophon (431–354), who has left excellent historic narratives, was also the earliest Greek essayist. The oldest piece of Attic prose is the essay on Athenian polity wrongly assigned to Xenophon. The study which oratory and rhetoric received in Athens was an important factor in shaping Attic prose, the chief orators being Demosthenes (384–322) with his contemporaries Æschines, Lycurgus, and others, and Demetrius of Phalerum (318) who ushered in the decline of oratory. Philosophy shared the development of history and oratory, reaching a rare elevation in Plato (429–347), a rare comprehensiveness in Aristotle (384–322), the founders of the academic and peripatetic schools.

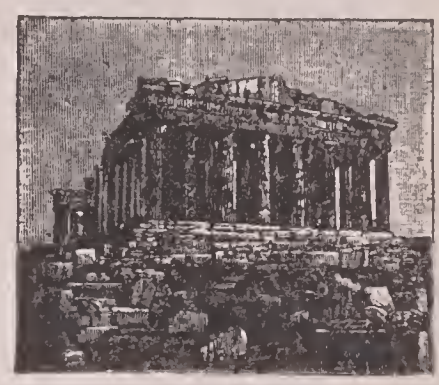
From about the year 300 B.C. the literary decadence may be held to date. During this period philosophy is in the main divided between Stoicism and Neoplatonism, the former represented by Epictetus (90 A.D.) and Marcus Aurelius (170), the latter by Plotinus (240), Porphyry, and Iamblichus.



Temple of Zeus at Olympia—Doric order.

On the fall of Constantinople in 1453 the cultivated classes who still retained the pure Greek either perished or took to flight, or adopted the language of the conquerors. The popular Greek, however, survived, and despite its vulgarization and the modification of its grammatical forms and syntax, it cannot be said that Greek has been a dead language at any period since Homer.

As in literature so in art the Greeks attained the highest pitch of excellence, and in architecture and sculpture furnished models for the rest of the world.



Greek architecture—The Parthenon at Athens, from the northwest.

In no other race has the artistic spirit been so generally diffused throughout the people, expressing itself in the minor arts of life, in the practical application of ornament in the forms of domestic furniture, pottery, metal work, mosaics, and the like, not less perfectly than in the master-works of architecture and sculpture.

Throughout the history of the art it is the public buildings, more particularly the temples, in which the genius of the Greeks displayed itself. The private houses remained simple and even rude in appearance, rarely rising above a single story, and having no external decoration. The temples were for the most part rectangular, though the circular form sometimes occurs in the later periods of Greek art. Three orders are distinguished in Greek architecture according to the treatment of the pillars and of the entablature—the Doric, Ionic and Corinthian (which see). The beauty of the Greek buildings was heightened in respect of form by a deviation from ordinary rectilinear construction, in the systematic substitution of delicately-curved lines for straight lines in the columns and steps of their temples, and wherever the illusion attending the sight of straight lines in perspective was likely to prove an element of weakness. The colonnades and porticoes, which were usually built round market-places and along quays in seaport towns, were similar in style to the temples. See also Architecture.

Greek sculpture has been divided into five principal periods, namely, 1. The Dædalian or Early (–580 B.C.). 2. The Æginetan or Archaic (580–480 B.C.). 3. The Phidian or Grand (480–400 B.C.). 4. The Praxitelean or Beautiful (400–250 B.C.). 5. The Decline (250 B.C. onwards). The age of Dædalus marks an advance from an earlier primitive

sculpture in which blocks of wood and stone were rudely fashioned into the semblance of life, the imperfections of the art being concealed by real hair and adventitious draperies. To Phidias, besides his statues of Athena and Zeus, were due the designs for the sculptures of the Parthenon, the actual work of these, however, being probably done by his pupils Alcamenes, Agoracritus, and other artists of his time. To this age belonged the sculptor and architect Polycletus (about 452–412 B.C.), whose statue of a youth holding a spear obtained the name of The Canon, as being a standard of form. About the same time the Bœotian sculptor Myron flourished, the famous Discobolus being a reproduction in marble of one of his bronzes. The Praxitelean period is characterized by greater grace and elegance in choice of subject and treatment, together with more of the sensual element making for ultimate decline. Praxiteles excelled in female figures, his Aphrodite at Cnidus in Caria being his most famous work. His rival, Scopas of Paros, was employed on the bas-reliefs of the Mausoleum at Halicarnassus, and was the sculptor of the famous group representing the destruction of the children of Niobe. In Lysippus of Sicyon, in the time of Alexander the Great, the Praxitelean school found its last great figure prior to the decline of the art.

Painting in Greece is said to have had its origin in Sicyon, and to have existed as mere outline and monochrome until Cimon of Cleonæ introduced variety in coloring, foreshortening, and a less rigid art. The Greek artists worked in wax or resin or in water-color, brought to the required consistency by mixing with gum, glue or white of egg; and they painted upon wood, clay, plaster, stone, parchment, and canvas. Until a late period, however, they rarely painted upon walls, usually painting upon panels or tablets to be encased in walls. The earlier masters appear to have used only four colors—red, yellow, white, and black, but by the time of Apelles and Protogenes many other pigments were in use.

GREEK CHURCH, or Holy Oriental Orthodox Apostolic Church, that section of the Christian Church dominant in Eastern Europe and Western Asia, especially in Turkey, Greece, Russia, and some parts of Austria. In the first ages of Christianity numerous churches were founded by the apostles and their successors in Greek-speaking countries; in Greece itself, in Syria, Egypt, Mesopotamia, Asia Minor, Thrace, and Macedonia. These were subsequently called Greek, in contradistinction to the churches, in which the Latin tongue prevailed. The removal of the seat of empire by Constantine to Constantinople, and the subsequent separation of the eastern and western empires afforded the opportunity for diversities of language, modes of thinking, and customs to manifest themselves, and added political causes to the grounds of separation. During the earliest period the chief seats of influence in the Eastern Church were Jerusalem, Antioch, and Alexandria, the seat of that mystical philosophy, by which the oriental church was distinguished. In 588 the phrase "Filioque" ("and the Son") was added by the Latins to the Nicene creed (which now read "proceeding from the father and the son"), an addition to which the Greek Church was opposed.

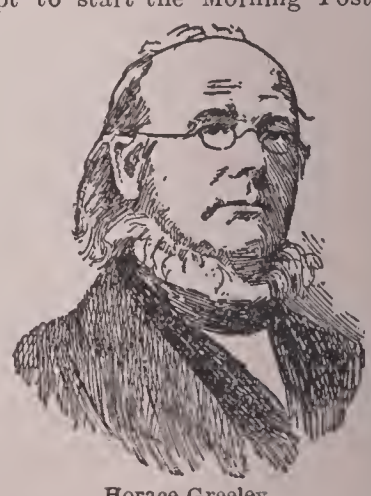
The Greek Church is the only church which holds that the Holy Ghost proceeds from the Father only; the Roman Catholic and Protestant Churches deriving the Holy Ghost from the Father and the Son. Like the Roman Catholic Church it has seven sacraments—baptism, chrism, penance, preceded by confession; the eucharist; ordination; marriage; and unction. But it is peculiar—1, in believing in baptism by threefold immersion, the chrism (confirmation) following immediately after it; 2, in adopting, as to the eucharist, the doctrine of the real presence and transubstantiation; but in ordering the bread to be leavened, the wine to be mixed with water, and both elements to be distributed to every one, even to children; 3, the parochial clergy are required to be married, but only once and to a virgin, and marriage must take place before ordination; widowed clergy are not permitted to retain their livings, but go into a cloister, where they are called hieromonachi. Rarely is a widowed bishop allowed to preserve his diocese. The Greek Church grants divorce in case of proved adultery, but it does not allow even the laity a fourth marriage. It differs also from the Roman Catholic Church in anointing with the holy oil, not the dying but the sick, for the restoration of health, forgiveness, and sanctification. It rejects the doctrine of purgatory, works of supererogation, indulgences, and dispensations, but admits prayers for the dead, whose condition appears to be considered undetermined until the final judgment. It recognizes no visible vicar of Christ on earth, but the spiritual authority of a patriarch is little inferior to that of the pope. It allows no carved, sculptured, or molten image of holy persons or subjects; but the representations of Christ (except in the crucifix), of Mary, and the saints, must be merely painted, and at most inlaid with precious stones. In the Russian churches, however, works of sculpture are found. In the invocation of the saints, and especially of the Virgin, the Greeks resemble the Latins. They also hold relics, graves, and crosses sacred; and crossing in the name of Jesus they consider as having a wonderful and blessed influence. Among the means of penance, fasts are particularly numerous with them. They fast Wednesday and Friday of every week, and besides observe four great annual fasts, namely, forty days before Easter; from Whitsuntide to the days of Sts. Peter and Paul; the fast of the virgin Mary, from the 1st to the 15th of August and the apostle Philip's fast, from the 15th to the 26th of November; besides the day of the beheading of John the Baptist, and of the elevation of the cross. The calendar of the Greek Church is in the old style, their new year's day falling on Jan. 13th.

The services of the Greek Church consist almost entirely in outward forms. Preaching and catechizing constitute the least part of it. Instrumental music is excluded altogether. The mass is considered of the first importance. The convents conform for the most part, to the strict rule of St. Basil. The Greek abbot is termed higumenos, the abbess higumene. The abbot of a Greek convent which has several others under its inspection is termed archimandrite, and ranks next a bishop. The lower clergy in the Greek Church consist of readers, singers, deacons, etc., and of priests or popes and protopopes or archpriests, who are the first clergy in the cathedrals and metropolitan churches. The members of the lower clergy can rise no higher than protopopes, for the bishops are chosen from among the monks, and from the bishops are selected the archbishops, metropolitans, and patriarchs. In Russia there are twenty-four dioceses. With which of them the archiepiscopal dignity shall be united depends on the will of the emperor. The seats of the four metropolitans of the Russian Empire are St. Petersburg, Kiev, Kason, and Tobolsk. In the Turkish dominions the dignities of Patriarch of Constantinople. Alexandria, Antioch, and Jerusalem still subsist. The Patriarch of Constantinople still possesses the ancient authority of his see; the other three patriarchs exercise a very limited jurisdiction, and live for the most part on the aid afforded them by the Patriarch of Constantinople.

GREEK FIRE, an inflammable and destructive compound used in mediæval warfare, especially by the Byzantine Greeks. It was poured from cauldrons and ladles, vomited through long copper tubes, or flung in pots, phials, and barrels. The art of compounding it was concealed at Constantinople with the greatest care, but it appears that naphtha, sulphur, and niter entered into its composition.

GREEK LANGUAGE, LITERATURE, ETC., See under Greece.

GREELEY, Horace, American journalist and politician, born at Amherst, N. H., in 1811; in 1831 he went to New York, where, after an unsuccessful attempt to start the Morning Post, the



Horace Greeley.

first penny paper, he commenced in 1834 to issue the Weekly New Yorker, which ran for seven years. The Log Cabin, another weekly, established by him in 1840, reached a circulation of 80,000, and gave him a reputation which ensured

the success of his Daily Tribune, founded in 1841, and edited by him till his death. In 1848 he was elected to congress, but failed to impress his constituents with the necessity of returning him a second time. In 1851 he visited Europe, and was one of the jurors in the Great Exhibition. He opposed the civil war, but was a firm supporter of the Union and of President Lincoln, and at the close of the war advocated a general amnesty and universal suffrage. In 1872 he was nominated for the presidency in opposition to General Grant, but was defeated. The strain of electioneering and the death of his wife brought on an illness, of which he died a few weeks later. Chief among his miscellaneous works are his Hints toward Reforms (1850), Glances at Europe (1851), History of the Struggle for Slavery Extension (1856), The American Conflict (1864) Recollections of a Busy Life (1869). He died in 1872.

GREE'LY, Adolphus Washington, American Arctic explorer and meteorologist, was born in Newburyport, Mass., in 1844. In July, 1861, he enlisted as a private in the Ninteenth Massachusetts volunteer infantry, in which he served throughout the war. In 1867 he was appointed a second lieutenant in the regular army. In 1881 he was appointed to command the government expedition planned in pursuance of the recommendations of the International geographical congress at Hamburg, in 1879, that thirteen circumpolar stations be established in the Arctic regions. The party wintered two years at Discovery Harbor, Grinnell Land, whence expeditions were sent both into the interior of Grinnell Land, and across the straits into Greenland, one of the exploring parties under Lockwood and Brainard reaching, in May, 1882, latitude 83° 24′, the farthest north attained up to that time. He was awarded the Founder's medal of the Royal geographical society, and the Roquette medal by the Société de géographie, Paris, and was promoted to the rank of captain in the United States army. In 1887 he was appointed by President Cleveland to succeed Gen. W. B. Hazen as chief signal officer, with the rank of brigadier-general.

GREEN, John Richard, historian, born in 1837. For some time he wrote constantly for the Saturday Review; but he was comparatively little known until the publication in 1874 of his Short History of the English People, which secured him immediate fame. It was followed by a larger edition of the same work entitled A History of the English People (1877–80), a volume of Stray Studies from England and Italy, and the Making of England (1882). Latterly his work was carried on in distressing conflict with lung disease, and he died in 1883. The Conquest of England, his last work, was published posthumously by his wife, being almost complete at his death.

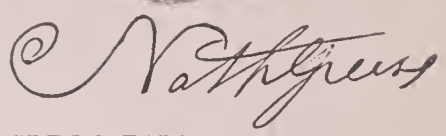
GREEN, Seth, American pisciculturist, was born in Rochester, N. Y., in 1817. He devoted his life to the artificial propagation of fish and the breeding of the better kinds for stocking lakes and streams. He stocked the Connecticut, the Hudson, the Potomac, and many other streams with enormous numbers of shad, trout, and other species. He also introduced shad into Pacific Coast waters. He died in 1888.

GREENBACK PARTY, greenbacks is the popular name given to non-interest bearing notes unsecured by gold or deposits of bonds, large numbers of which notes were issued during the civil war. Their issue resulted in an inflation of the currency which naturally was followed by an increase in prices especially of agricultural products. With the contraction of the currency which followed the limiting of unsecured paper money there was a fall of prices. This being coincident with a period of agricultural and business depression a demand for the retention of the greenbacks arose and the supporters of the idea held a convention in 1874 at which the government was asked to withdraw all bank currency and issue only national currency and to pay the national debt in the "greenbacks." Many democrats favored the idea but as the party as a whole refused to indorse these views the Greenback Party was organized in 1876 with Peter Cooper, the New York philanthropist as its candidate for the presidency. The party polled 80,000 votes mainly in the middle west. Labor troubles in 1878 led to the fusion with local workingmen's parties under the name Greenback-Labor Party and in that year they polled 1,000,000 votes at the congressional elections electing 14 congressmen. James B. Weaver, the presidential candidate in 1880 received 300,000 votes and eight congressmen were elected. The last candidate of the party was General Benjamin F. Butler, who in 1884 received 150,000 votes.

GREENBACKS, the popular name given to the paper currency first issued by the United States government in 1862 during the civil war. It is sometimes used also to include United States bank-notes.

GREEN BAY, a city in Wisconsin, on Fox river, near the head of Green Bay. It has a great trade in lumber and various flourishing industries. Pop. 21,526.

GREENE, Nathaniel, a general of the American revolutionary army, was born at Potowhommet, Rhode Island, in 1742. In 1770 he was elected to represent Coventry in the general assembly of Rhode Island, and was soon after excommunicated by the Quakers for taking arms on the prospect of war with Britain. In 1774 he joined the Kentish Guards as a private, and in May, 1775 he was appointed brigadier-general and commander of the Rhode Island contingent in the army before Boston. He gained at once the confidence of Washington, was made major-general and appointed to the command in New Jersey. At Trenton (1776) and Princeton (1777) he led a division, and in the subsequent fighting he held important commands, and repeatedly distinguished himself. In 1778 he was quarter-master-general, and in 1780 presided at the trial of Major André. In the same year he was appointed to the command of the southern army, and succeeded, after repeated defeats, in wresting Georgia and the Carolinas from the British. He died in 1786.



GREEN EARTH, an opaque, dull, olive-green, soft, earthy mass, generally met with in cavities in amygdaloidal rocks. It consists of silicate of iron and aluminium, with potassium and sodium in water.

GREEN-EBONY, an olive-green wood obtained from a South American tree, used for round rulers, turnery, marquetry work, etc., and also much used for dyeing, yielding olive-green, brown, and yellow colors.

GREENFINCH, GREEN-LINNET, or **GREEN GROSBEAK,** a bird of the finch family, and one of the most common of British and European birds. It frequents hedges, gardens, and small plantations, and feeds on grain, seeds, or insects. Its song is not melodious, but it easily becomes tame. It builds in hedges, bushes, and low trees, the nest being of green moss and coarse fibrous roots, lined with finer roots, horse-hair, and feathers. The eggs (four to six) are bluish white, spotted at the larger end with purplish gray and dark brown. The general colors of the male are green and yellow, those of the female inclining to brown.

GREEN GAGE, a variety of the plum, the reine claude of the French, introduced into Britain by a person named Gage. It is large, of a green or yellowish color, and has a juicy, greenish pulp of exquisite flavor.

GREENLAND, an extensive island belonging to Denmark, situated on the northeast of the continent of North America, from which it is separated by Davis's Straits, Baffin's Bay, and Smith's Sound. A small part of its northern and precipitous eastern coast is yet unknown but it does not extend further north than about lat. 83°. Like the northern parts of N. America generally, Greenland is colder than the corresponding latitudes on the east side of the Atlantic. In June and July the sun is constantly above the horizon, the ice on the coast is broken up and floats southward, and a few small lakes are opened; but the short summer is followed by a long and dreary winter. The interior, which is lofty and has the appearance of one vast glacier is uninhabitable, and all the

villages are confined to the coasts, which are lined with numerous islands, and deeply penetrated by fiords. The Danish colony extends north, on the western coast, to the Bay of Disco, in lat. 69° n. The inhabitants are largely dependent upon hunting and fishing. Whale blubber and seal oil are used as fuel. Despite the proximity of America the flora and fauna are rather of an European character. The land animals are the Esquimaux dog, the reindeer, the polar bear, the Arctic fox (blue and white), the ermine, the Arctic hare, and the musk ox. Among the amphibia the walrus and several species of seal are common. The seas abound in fish, the whale and cod fisheries being of special importance. Sea-fowl are abundant in summer, and largely killed. The chief mineral product is cryolite, but graphite and miocene lignitic coal are also found. Oil, eider down, furs, and cryolite are exported. The population, which is chiefly Esquimaux. numbers about 10,000.

GREEN MOUNTAINS, a mountain range, commencing near New Haven, Connecticut, and extending north through Massachusetts and Vermont, between Lake Champlain and the Connecticut river. The highest summits are Mansfield Mountain (4279 feet) and Camel's Hump (4188) feet, both in Vermont.

GREENOCK, a parliamentary burgh and seaport town of Scotland, county Renfrew, on the southern shore of the estuary of the Clyde, here between 3 and 4 miles wide, about 20 miles west by north of Glasgow. Pop. 68,142.

GREEN PAINTS, are for the most part compounds of copper and of chromium. The best known greens are the following: Bremen green, or verditer, consisting mainly of a basic carbonate of copper. Brunswick green, a hydrated oxychloride of copper; but the name is sometimes given to a hydrated basic carbonate, also known as mountain green. Chrome and emerald green are oxide of chromium. Emerald green (which see) is also used as synonymous with Schweinfurt green. English green is a mixture of Scheele's green with gypsum. Guignet's green is oxide of chromium prepared in a peculiar way. Hungary green is a kind of malachite found in Hungary. Rinman's green is got by heating zinc oxide with a cobalt compound. Saxony green is an indigo color used in printing. Scheele's green is arsenite of copper, and Schweinfurt green, Veronese green, and Vienna green, are also compounds of arsenic and copper. Verdigris is a hydrated basic carbonate of copper, often seen in copper saucepans. Besides there are green colors derived from plants. Of these may be mentioned chlorophyll, the green color of leaves; sap green, the juice of Rhamnus catharticus or buckthorn, made into a green lake with alumina; Chinese indigo-green, etc.

GREEN RIVER, a river in Kentucky, flows generally west and north-west, and enters the Ohio 200 miles below Louisville. It is navigable for boats for about 200 miles.

GREENSBORO, the county seat of Guilford co., N. C., on the Richmond and Danville and the Cape Fear and Yad. Valley railways; 48 miles s.s.w. of Danville, 81 miles w.n.w. of Raleigh. It is in a tobacco, wheat, corn, oats, and fruit region, with gold, copper, and iron mines. Pop. 12,160.

GREENSHANK, a well-known species of sand-piper often called the whistling snipe from the shrill note it utters when first flushed. The bird is about 12 inches long, rather prettily marked, and has the legs and toes olive-green.

GREEN-SICKNESS. See Chlorosis.

GREEN-TEA, a tea of a greenish color. The green color should be due to the mode in which the leaves of the tea are treated in the process of drying.

GREENVILLE, the county seat of Greenville co., S. C., on the Car., Knox. and W., the Port Royal and W. Car., and the Richmond and Danville Railways; 141 miles n. w. of Columbia, 158 miles e.n.e. of Atlanta, Ga. Pop. 14,170.

GREEN-VITRIOL, a name formerly given to sulphate of iron.

GREENWICH (grēn'ich), a mun. and parl. bor. in the county of London, on the right bank of the Thames, about 5 miles s.e. of London bridge. There are extensive iron foundries and engineering works, barge and boat-building yards, boiler works, mast, block, and sail works, telegraph cable works, roperies, chemical factories, etc. The object of greatest interest is the magnificent hospital, the oldest portion of which was originally a palace of Charles II. In 1865, it ceased to be an asylum for seamen, and is now the seat of the Royal naval college for the education of naval officers. It also contains a naval museum and picture gallery. Adjoining it are the Royal naval school for boys, and an infirmary for sick and disabled seamen. The celebrated observatory of Greenwich, erected by Charles II. for Flamsteed, stands upon an eminence in the park. The longitude of all British maps and charts, also of those issued by the government of the United States of America, as well as many of those published in other countries, is computed from this observatory, which is 2° 20′ 23″ w. from the observatory of Paris, and 18° e. from the meridian of Ferro. Pop. 95,757.

GREG, William Rathbone, English writer, born in 1809. Besides his miscellaneous essays and pamphlets (collected in 1881 and 1882) he was the author of Sketches in Greece and Turkey (1833), The German Schism and the Irish Priests (1845), The Creed of Christendom (1851), Essays in Political and Social Science (1853), Enigmas of Life (1872), Rocks Ahead (1874), and Literary and Social Judgments (1877). He died in 1881.

GREGORIAN CALENDAR, the calendar as reformed by Pope Gregory XIII. in 1582.

GREGORY, the name of thirteen popes, of whom we need notice only the following: Gregory I., called also the Great, born at Rome, of noble family, about 540. He became a member of the senate, and was made a prefect of Rome in 573. He expended his inheritance in the foundation of monasteries and charitable institutions, and then took monastic vows himself. Pope Pelagius II. sent him on an embassy to Constantinople, and afterward made him papal secretary. On the death of Pelagius in 590 he was chosen his successor. He displayed great zeal for the conversion of heretics, sending missionaries to Sicily, Sardinia, Lombardy, England, etc., as well as for the advancement of monachism, and the enforcement of clerical celibacy. He died in 604. The work ascribed to him are very numerous; his genuine writings consist of a treatise on the Pastoral Duty, Letters, Scripture Commentaries, etc. Gregory VII. (Hildebrand), born about 1020 at Soana, in Tuscany; passed part of his early life in Rome, became a monk at Cluny, and then returned to Rome with Druno on the election of the latter to the papal chair. He exercised great influence over Leo IX. (Pruno) and his successors, Victor II., Nicholas II., and Alexander II.; and under Nicholas II. he succeeded in depriving the clergy and people of Rome of a voice in the election to the pontificate by giving the power of nomination to the cardinals alone. On the death of Alexander II. (1073) he was raised to the papal chair. His chief aim was to found a theocracy in which the pope should be the sovereign ruler, in political as well as ecclesiastical matters. He therefore prohibited simony and the marriage of priests (1074), and abolished lay investiture (1075), the only remaining source of the authority of princes over the clergy of their dominions. The Emperor Henry IV. refused to obey this decree, and Gregory, after deposing several German bishops who had bought their offices of the emperor, and excommunicating five imperial councillors concerned in his transaction, summoned the emperor before a council at Rome to defend himself against the charges brought against him. Henry then caused a sentence of deposition to be passed against the pope by a council assembled at Worms. The pope, in return, excommunicated the emperor, and Henry, finding himself in difficulties, went to Italy and submitted at Canossa (1077) to a humiliating penance, and received absolution. After defeating Rudolph of Suabia, however, Henry caused the pope to be deposed by the council of Birxen, and an anti-pope, Clement III., to be elected in 1080, after which he hastened to Rome and placed the new pope on the throne. Gregory passed three years as a prisoner in the castle of St. Angelo, and though finally liberated by Robert Guiscard, he was obliged to retire under the protection of Guiscard to Salerno, where he died in 1085. Gregory XIII. (Ugo Buoncompagno), born at Bologna in 1502; created cardinal in 1565; chosen successor of Pius V. in the popedom in 1572. He permitted the Cardinal of Lorraine to make a public thanksgiving for the massacre of St. Bartholomew, encouraged plots against Queen Elizabeth, and incited Philip II. to attack her. His foreign policy cost him much money for subsidies to excite enemies to the Turks and heretics, and his financial expedients to fill his exchequer ruined the trade and disturbed the peace of his own dominions. He did much to encourage education, his expenditure for this pur-

pose exceeding two million Roman crowns, out of which many colleges at Rome were endowed. He reformed the Julian calendar (see Calendar). He died 10th April, 1585.

GREGORY, James, mathematician and inventor of the reflecting telescope, was born at Drumoak, in Aberdeenshire, about 1638. In 1663 he published Optica Promota, explaining the idea of the telescope which bears his name. He spent some years in Italy, and published at Padua in 1667 a treatise on the Quadrature of the Circle and Hyperbola. He died suddenly in 1675.

GRENA'DA, one of the British West Indian Islands; about 85 miles northwest of Trinidad; oblong in form, 24½ miles long, n. and s., and 10 miles broad; area 133 sq. miles. Pop. 64,288 (about 900 whites).

GRENADE, a small hollow bullet or ball of iron or other metal, or annealed glass, about 2½ inches in diameter, filled with gunpowder, and fired by a fuse, so as to cause it to burst when thrown among the enemy. The term was first used by Du Billey, in reference to the siege of Arles (1536). Until about the end of the 17th century, when musketry became common, soldiers of the line were trained to throw grenades by the hand, hence the name grenadier. See the following article.

GRENADIER, originally a soldier destined to throw the hand-grenades. Soldiers of long service and acknowledged bravery were selected for this service, so that they soon formed a kind of élite. There were at first only a few grenadiers in each regiment. Companies of grenadiers were formed in France in 1670, in England a few years later. With the development of the musket the name soon became only a souvenir of the ancient practice; the troops so called generally formed one battalion of a regiment, distinguished by the height of the men and a particular dress, as, for instance, the high bear-skin cap. With the British and French the grenadier company was the first of each battalion. The name in the British army remains only in the regiment of Grenadier Guards.

GREN'ADINE, a thin gauzy silk or woolen fabric, plain, colored, or embroidered, used for ladies' dresses, shawls, etc.

GREN'ADINES, a chain of small islands and rocks, West Indies, between the islands of Grenada and St. Vincent; principal island, Carriacou. They produce coffee, indigo, cotton, and sugar. Pop. about 7000.

GRENO'BLE, a fortified town of southern France, capital of dep. Isère, finely and strongly placed on the Isère, 60 miles s.e. Lyons. It has a cathedral, and a noteworthy church (Saint-André), with the tomb of Bayard; a public library of 170,000 volumes and 7500 MSS.; a college, museum, bishop's palace, court-house, arsenal, and extensive public gardens. The manufactures consist of gloves, linen goods, liqueurs, leather, etc. Pop. 68,052.

GRENVILLE, George, a British minister, younger brother of Earl Temple, and father of William Wyndham the first Lord Grenville; born in 1712; died in 1770. He became treasurer of the navy in 1754; secretary of state and subsequently Irish lord of the admiralty in 1762; first lord of the treasury and chancellor of the exchequer in 1763. In 1763 he introduced a scheme of colonial

George Grenville.

taxation, and in 1764 proposed a stamp tax to be levied in the American colonies which was one of the causes of the American war of independence. In 1765 he was succeeded in office by Lord Rockingham.

GRENVILLE, Sir Richard, one of England's naval heroes, a cousin of Sir Walter Raleigh, born about 1541. Sir Richard died in 1591. Tennyson's grand ballad of The Revenge is well known.

GRENVILLE, William Wyndham, Lord, third son of George Grenville, was born 1759. In 1783 he was appointed paymaster-general of the army; in 1789 became speaker, and in the same year became secretary of state for the home department. In 1790 he was created Baron Grenville, and from 1791 till Pitt's resignation in 1801 held the post of foreign secretary. On the return of Pitt to office in 1804 he declined to join him, and continued in opposition till Pitt's death, when he became the head of a coalition ministry, including Fox and Grey, 1806. This ministry resigned in 1807, after having passed an act for the abolition of the slave-trade. He id not again take office. He died in 1834.

GRESHAM, Walter Quinton, American jurist and politician, was born near Lanesville, Harrison co., Ind.; was admitted to the bar in 1853, and in 1860 was elected as a republican to the state legislature. In 1861 he enlisted as a private in the Thirty-eighth volunteers. For bravery at the siege of Vicksburg he was promoted to be brigadier-general. He was appointed in 1869 by President Grant United States district judge for Indiana, and in 1882 resigned his seat on the bench in order to accept President Arthur's tender of the office of postmaster-general. In 1884 he was made secretary of the treasury, a position which he held for a few months, when he was appointed United States circuit judge for the seventh judicial circuit. He was a candidate for the republican nomination for president in 1884 and 1888. He was appointed secretary of state by Cleveland in 189?. Died 1905.

GRETNA GREEN, a village of Scotland, in Dumfriesshire, on the Solway Firth, 8 miles north of Carlisle, for nearly a century notorious for the celebration of the marriages of fugitive lovers from England. To conclude a lawful (though irregular) marriage in Scotland, it is only necessary for an unmarried couple to go and declare themselves man and wife before witnesses, and it was in this way that these runaway couples were married; but such marriages were put an end to in 1856, by an act declaring that no irregular marriage in Scotland shall be valid unless one of the parties has resided in Scotland for twenty-one days next preceding such marriage.

GREY, Charles, Earl, English statesman, eldest son of Charles, first Earl Grey; born in 1764; died in 1845. He was educated at Eton and at King's college, Cambridge. In 1786 he was returned to parliament as member for Netherlands. On the accession of the Grenville ministry in 1806, Grey, now Lord Howick, was made first lord of the admiralty, and on the death of Fox succeeded him as secretary for foreign affairs and leader of the House of Commons. The death of his father in 1807 raised him to the House of Peers, and

Earl Grey.

from this period up to 1830 he headed the opposition in the lords, and especially opposed the proceedings against Queen Caroline. On the accession of William IV. and the retirement of the Wellington ministry, Earl Grey was summoned to office. The great event which marks his administration is the passing in 1832 of the first reform bill. In 1834 Earl Grey resigned, and was succeeded by Lord Melbourne. The remainder of his life was chiefly spent in retirement.

GREY, Lady Jane, an interesting figure in English history, the daughter of Henry Grey, marquis of Dorset, afterward duke of Suffolk, by Frances, daughter of Charles Brandon, duke of Suffolk, and Mary, younger sister of Henry VIII., in whose reign Lady Jane was born, in 1537. She displayed much precocity of talent; and under the tuition of Aylmer, afterward bishop of London, she acquired a knowledge of the learned languages, as well as French and Italian. She was married to Lord Guildford Dud-

ley, fourth son of the Duke of Northumberland, in 1553. Edward VI., who died in 1553, was induced on his deathbed to settle on her the succession to the crown. The council endeavored to keep his death secret, with a view to secure the persons of the princesses, Mary and Elizabeth, and when Mary discovered the design the council proclaimed Lady Jane queen. On the approach of Mary, however, the council deserted Lady Jane, and Mary was proclaimed queen. She was beheaded on Tower Hill, February 12, 1554, her husband having previously suffered the same day.

GREY FRIARS. See Franciscans.

GREYHOUND, a variety of dog, distinguished by a greater length of muzzle than any other; very low forehead, short lips, thin and long legs, small muscles, contracted belly, and semipendent ears. There are several varieties, as the Irish greyhound, the Scottish, the Russian, the Italian, and the Turkish. The common greyhound is of an elegant make of body, and is universally known as the fleetest of dogs. A good hound has a fine, soft, flexible skin, with thin, silky hair, a great length of nose, contracting gradually from the eye to the nostril, a full, clear, and penetrating eye, small ears, erect head, long neck, chest capacious, deep, but not wide, shoulders deep and placed obliquely, ribs well arched, contracted belly and flank, a great depth from the hips to the hocks of the hindlegs, fore-legs, straight and shorter than the hinder. The name appears to have no reference to the color, but is derived from the Icelandic grey, a dog. They are chiefly used in the sport of coursing, a work for which their peculiar shape, strength, keenness of sight and speed make them exceedingly well fitted. This sport is preferred by many to horse-racing and large kennels of greyhounds are kept by several of the nobility and gentry, who also further the sport by preserving hares, and providing suitable coursing grounds. The chief breeds are the Newmarket, the Lancashire, and the Scotch.

GRIFFIN, or **GRYPHON,** a fabulous monster of antiquity, also common in heraldry, commonly represented with the body, the feet, and claws of a lion,

Medieval griffin.—Porch of the Duomo, Verona, Italy.

and the head and wings of an eagle. India, or Scythia, was anciently assigned as the native country of the griffins; and it was alleged that they guarded the gold in the mountains.

GRIMAL'DI FAMILY, one of the four families of the high nobility in Genoa. The lordship of Monaco belonged, for more than 600 years (beginning with 980), to the Grimaldi, and the ruler is still a Grimaldi. With the Fieschi they always played an important part in the history of Genoa, especially in the disputes between the Ghibellines and the Guelfs, to which latter party both families belonged.

GRIMALDI'S FRINGES, a term in optics given to the colored bands observed when a beam of light passing through a narrow slit falls on a screen.

GRINDING, a mechanical process in which certain effects are produced by attrition. This process prevails in various mechanical arts, as in grinding corn, etc., the object of which is to reduce the materials to a fine powder; or in grinding metals for the purpose of giving them a certain figure, polish, or edge. In the first case the grinding or crushing is effected by rough stones, or, as in crushing ores, between heavy metal cylinders, by or a heavy stone or iron cylinder revolving upon a smooth plate. (See Mill.) The grinding of cutlery is effected by means of the grindstone (see below); emery powder grinds glass lenses and specula. Ornamental glass is ground into facets by stones and lap-wheels. Diamonds and other precious stones are ground with diamond dust. What is called dry grinding is the grinding of steel with dry grindstones. The points of needles are produced by this means, also the finishing of steel pens. Sand-jet grinding is a process in which abrasion is effected by the percussion of small hard particles on a plain surface, sharp siliceous sand being impelled by a blast artificially produced of steam or of air. By the use of flexible jointed connecting tubes the jet can be turned in any direction.

GRINDSTONE, a cylindrical stone, on which sharpening, cutting, and abrasion are effected by the convex surface while the stone is revolving on its axis. They are made of sandstone, or sandstone grit of various degrees of fineness. Artificial grindstones have been successfully tried.

GRIQUALAND EAST, a district of South Africa, lying south of Natal between Pondoland and Basutoland; fertile and suited for stock-raising. It was incorporated with Cape Colony in 1874. Area, 7480 sq. miles. Pop. about 153,000.

GRIQUALAND WEST, a district of South Africa north of the Orange river, and west of the Orange River colony; 180 miles from east to west, and 120 from north to south; area, about 17,800 sq. miles. The prevailing character of the surface is that of undulating grassy plains suitable for grazing. In 1870 large finds of diamonds in that district began to attract wide notice, and in 1871 Waterboer, the Griqua chief, ceded all his rights to the British government, and the territory was incorporated with Cape Colony. The chief center of the diamond-mining industry, and the seat of government, is Kimberley. Pop. estimated at 84,000.

GRISONS (grē-sōn), the largest and most easterly canton of Switzerland, bordering on Austria and Italy; area, 2773 sq. miles. The climate varies greatly, ranging from the perpetual winter of the mountains to the almost Italian air of some of the valleys. The canton is in general pastoral, feeding large numbers of cattle and sheep. The mountain forests supply much timber. A considerable transit trade is carried on between Italy and Germany. The canton was admitted into the confederation so late as 1803. Both the protestant and the Roman Catholic religion are established. The language of the public acts is German, and the people speak German, Romanish, or Italian. Pop. 104,510.

GRISWOLD, Rufus Wilmot, D. D., American writer, born in Vermont, 1815. After having traveled extensively both in his own country and in Europe, he became successively a printer, a baptist preacher, and a journalist. He was the author of The Poets and Poetry of America, etc. He was one of the editors of Edgar A. Poe's works. He died in 1857.

GRIT, is a sandstone, coarse-grained, with particles more or less angular, connected by a cement of a hard siliceous nature.

GROATS, the seeds of oats prepared as an article of food by being deprived of their hulls. They are much used in the preparation of gruel for invalids.

GRODNO, a town, Russian Poland, capital of the government of same name, on the Niemen, 160 miles, northeast of Warsaw, Pop. 49,788.—The government has an area of 14,931 sq. miles, largely occupied by pine forests and swamps. Pop. 1,321,157.

GROIN, the angular curve made by the intersection of two semi-cylinders or arches. It is either regular or irregular: —regular, as when the intersecting

a a, Groins.

arches are of the same diameters and heights; and irregular, when one of the arches is semi-circular, and the other semi-elliptical. In Gothic architecture groins are always ribbed.

GRONINGEN (grō'ning-en), a town of Holland, capital of a province of same name, situated on the river Huns, here converted into a canal, 92 miles northeast of Amsterdam. Pop. 67,563.—The province forms the north-eastern portion of Holland; area, 790 sq. miles. It is protected against the encroachments of the sea by dykes, is very level, and is intersected by innumerable canals. The inhabitants, 302,681, nearly all belong to the Calvinistic Church.

GROSBEAK, a general popular name for birds of at least three groups belonging to the conirostral division of the Insessores. The first comprises the crossbills; in the second group is the East Indian representative genus, with the beak large and parrot-like, but not crossing; the third group includes the pine grosbeak and the bullfinch. The term

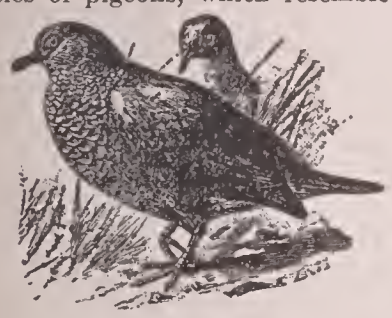
grosbeak was given to birds which had beaks proportionally larger than in the most familiar forms.

GROTE, George, English historian and politician, was born in 1794, died in 1871. In 1846 appeared the first two volumes of his History of Greece. The remaining ten volumes followed in rapid succession, the final volume being published in 1856. The work terminates with the death of Alexander the Great, and as a whole is a monument of erudition. In 1865 he published Plato and the Other Companions of Socrates, and was engaged at the time of his death on an elaborate treatise on Aristotle and the Peripatetics. In the latter part of his life he was concerned in the management of University college, the London university, and the British museum.

GROTESQUE, in art, a capricious variety of arabesque ornamentation, which, as a whole, has no type in nature, the parts of animals, plants, and other incongruous elements being combined together; used by the Romans in decorative painting and revived by the artists of the renaissance.

GROUCHY (grō'shē), Emmanuel, Marquis, de, a noted French general, born at Paris, 1766. He entered the Royal life guards at the age of fourteen, saw much service, and highly distinguished himself. In the war with Prussia in 1806, and Russia (1807), and at Wagram, he acquired increased renown. In 1815 he defeated Blücher at Ligny. Having been ordered to follow the Prussian retreat, he was unable to aid Napoleon at Waterloo. He was banished under the second restoration, and lived for a few years at Philadelphia. He returned to France in 1821, and died in 1847.

GROUND DOVE, a name of various species of pigeons, which resemble the



Dwarf ground-dove.

gallinaceous birds in living mainly on the ground, their feet being better suited for walking than perching.

GROUND-HOG. Same as Aard-vark.

GROUND IVY, a common British plant with a creeping stem and purple flowers. Tea made from it is used by the poor for pectoral complaints. It was formerly employed to flavor ale.

GROUND-NUT, a term which denotes the seeds or pods of certain umbellifers (earth-nuts)' The nut or pod is situated at the end of a stalk of some length and is ripened under ground, this stalk having the peculiarity after flowering of bending down and pushing the fruit into the earth. The plant is extensively cultivated in tropical countries. The nuts have a flavor similar to almonds, and yield an oil that may be used for olive-oil. See Peanut.

GROUND-PINE, a herbaceous labiate plant, so called from its resinous smell. Also a name given to some lycopods or club-mosses.

GROUND-RENT, in English law, is the rent paid to a landowner by a person for the use of ground on which buildings are erected. The usual arrangement is

Ground-nut.

for a specified time, generally ninety-nine years. On the expiration of this period the whole of the buildings become the property of the ground-landlord.

GROUND SQUIRREL, the name of squirrels somewhat resembling the marmot. They differ from the common squirrel in possessing cheek-pouches, and in retreating into burrows. They are well known in America, but species are also found in Asia and Africa.

GROUSE, the general name of gallinaceous birds, whose distinguishing mark is a naked band, often of a red color, in place of an eyebrow. They are wild, shy, and almost untamable. They live in

Red grouse.

families, in forests and barren regions, and feed on berries, buds, and leaves. They are polygamous, the male abandoning the female, and leaving to her the whole care of the progeny. The eggs number eight to fourteen. To this genus belong several species peculiar to North America, the most remarkable of which is the pinnated grouse or prairie hen, which inhabits open desert plains in particular districts of the Union. The male is furnished with wing-like appendages to his neck, covering two loose, orange sacs, capable of being inflated. Another species is the cock of the plains (which see). See also Hazel Grouse, Ruffed Grouse, Sand Grouse.

GROVES, among various ancient nations groves have been, probably on account of the mental impressions their stillness is calculated to make, considered as suitable localities for religious rites. The Hebrew word asherah, translated "grove" in the authorized version of the Old Testament, seems to signify some idol or idolatrous symbol. See Asherah.

GROW, Galusha Aaron, American politician, was born at Ashford, Conn., in 1823. In 1851 he was elected to congress from Pennsylvania and continued to be a member of that body until 1863. He was speaker of the house of representatives from 1861–1863. He declined the Russian mission in 1879. From 1894 until his death in 1906 he was congressman at large from his state.

GRUB, the term applied to the soft, wormlike larvæ of coleopterous and other insects. Some species do much injury to the roots of plants, growing corn, etc.

GRUBBER, an agricultural implement for tearing and loosening soil, and for eradicating roots, etc. It consists of an iron framework with handles and wheels, and provided with curved tines or teeth. In the most approved kinds the wheels are arranged three in front, and two behind. The depth to which the teeth may penetrate is regulated by suitable mechanism.

GRUGRU, the larva of the palm weevil, found in the tropical parts of America. It is of the length and thickness of a man's thumb, burrows in cabbage-palms, and canes, and is, when cooked, considered a great delicacy.

GRUNT, Grunter, an American fish, also termed pig-fish and red-mouth. The first of these names relates to the sound it emits when taken out of the water, the last to blood-red marks on the gums or lips. The Growler, found in America, also emits a grunting sound.

GRUS, the genus to which the crane belongs.

GRYSBOK, a species of antelope found in Southern Africa. It attains about 3 feet in length, is 1½ feet high at the shoulder, and its color is reddish-gray. It is hunted for the sake of its flesh.

GUACHARO, a bird of the goat-sucker family, of nocturnal habits, a native of South America, and found in great numbers in certain caves of Venezuela, Trinidad, and elsewhere. It is about the size of a common fowl, with a curved and toothed bill, wings long and pointed. It is called also Oil-bird.

GUADALAJARA (gwä-dä-lä-hä'rä), a town in Spain, capital of the province of same name, on the Henares, 44 miles northeast of Madrid. Pop. 8503.—The province, area 7012 sq. miles, is mountainous, or forms part of an elevated plateau. Pop. 205,495.

GUADALAJARA, a city of Mexico, capital of the state of Jalisco, in the fruitful valley of Atemajac, on the Rio de Santiago; a large and handsome city, with a fine cathedral and other good buildings; a university, a mint, convents, etc. Various manufactures are carried on, as those of silversmiths' and goldsmiths' wares, paper, leather, hats, pottery, cloth, etc. Pop. 95,000.

GUADELOUPE (gä-dē-löp), one of the French West Indies, composed of two

portions, separated by a narrow arm of the sea called Rivière Salée (Salt River). The western and larger portion is Basse-terre, or Guadeloupe Proper, 27 miles long by about 15 miles broad. The eastern portion, called Grande terre, is nearly 30 miles long by 10 to 12 miles broad. Guadeloupe Proper is of volcanic formation, the culminating point being La Soufrière, 5018 feet. Grande-terre, on the other hand, is generally flat, and of coral formation. Guadeloupe is watered by a number of small streams which become dry in summer. Grande-terre has only a few springs of brackish undrinkable water. The climate is hot and unhealthy, with a remarkably humid atmosphere, and hurricanes are frequent and destructive. The soil is fertile. The chief exports are sugar, coffee, dye and cabinet woods, pepper, manioc, tobacco, etc. The chief town is Basterre. Pop. 172,097, or with dependencies (Marie Galante, Desirade, etc.), 200,000.

GUAIACUM (gwī'a-kum), a genus of plants, containing four or five arborescent species, natives of the West Indies and the tropical parts of America. Among other uses it is employed in the

Guaiacum plant.

construction of ornamental articles of furniture, being susceptible of a fine polish. This tree yields the resin known as guaiacum, which either flows spontaneously from the tree, or from incisions or perforations in the stem, or is got by extraction by means of spirit from the wood. It is greenish-brown, has a balsamic odor, taste somewhat bitter and pungent, and it dissolves freely in spirit, but it insoluble in water. Its chief use is in medicine, the resin (as well as a decoction of the bark and wood) acting as a stimulant in chronic rheumatism, and being used also in gout, scrofula, syphilis, etc.

GUAIRA. See Guayra.

GUAM (gwäm), the largest of the Ladrone Islands, lying in the Pacific Ocean, and belonging to the United States. It is about 1500 miles east of Manila, and nearly the same distance southeast of Yokohama. It is 31 miles long and from 5 to 7 miles wide, and has an area of about 195 sq. miles. The climate is humid, with rain at all seasons but not unhealthful. The cocoanut-palm and the bread-fruit tree, rice, sugar, and indigo are cultivated, and the farms are well stocked with domestic animals. The island is of little importance to the United States except as a naval station and port of transit between America and Asia, to which end the harbor of Apra is being extensively improved. The population is about 9000, of whom more than half live in the capital, Agaña. Guam was captured by the United States cruiser Charleston on June 21, 1898, and by the treaty of Paris was ceded by Spain to the United States.

GU'AN, a gallinaceous bird. The sides of the head and front of the throat are naked and wattled, the wattles capable of inflation. The name Guan is more particularly applied to the largest bird of the genus, measuring about 30 inches. The guans perch on trees, descending in search of grain and fruits, and are natives of Brazil and Guiana.

GUANACO (gwän-a'ko), a South American ruminant, closely akin to the llama, alpaca, etc. It abounds most in Chili and Patagonia.

GUANAXUATO (gwä-nä-hwä'tō), a city of Mexico, capital of the state of the same name, 160 miles northwest of Mexico. Pop. 56,000.—The state is situated in the center of Mexico; area, 11,411 sq. miles; population, 968,113. Its mines, once the richest in the world, still yield a large amount of gold and silver. The surface is traversed by the cordillera of Anahuac, 9711 feet in height.

GUAN'O (Peruvian huano, dung), a valuable manure, consisting of the partially decomposed and dry excrement of the fish-eating seabirds, which has in some places accumulated in great masses. The name has been also extended to accumulations of a similar kind from land birds, and even from bats in caverns. Owing to the fact that rain washes such deposits away, great accumulations of guano exist principally in hot and dry tropical regions. The most important of all were the deposits on the Chincha Islands off the coast of Peru, which yielded a considerable revenue to the country, but are now quite exhausted. From 1853 to 1872 about 8,000,000 tons were got from these islands. Other deposits of less extent have from time to time been found, and Peru still remains the chief source of supply, its deposits being now, however, worked under the Chilian government. Guano varies extremely in composition, but it may be roughly divided into nitrogenous and phosphatic. The first of these contains about 21 per cent of ammonia. This is the case with the Peruvian variety, which contains almost all the inorganic matter required by a plant, and that in a highly available form, so that it is looked upon as one of the best of all fertilizing agents for different crops. Its use as a manure was was known to the native Peruvians centuries ago, but no attention was paid to the accounts by modern travelers of its wonderful efficacy until A. von Humboldt brought some to Europe and had it analyzed. It began to be brought to Europe about 1846. It is used raw or in its natural state, but most of the phosphatic guanos (some of which hardly deserve the name of guano) require to be dissolved by sulphuric acid before using. There are also manures known as fish guano, prepared from fish or fish refuse, flesh guano, blood guano, etc. Large quantities of fish guano are made in the United States from the menhaden, the oil being first extracted.

GUARDIAN, in law, the custodian of persons incapable of directing themselves and especially of infants, that is persons under 21 years of age. They may be said to be of five kinds: 1st, testamentary, or appointed by will; 2d, customary, by local usage; 3d, ad litem, or appointed by a court in order to conduct legal proceedings; 4th, by appointment of chancery; 5th, in tort, or by intrusion. Guardianship lasts in the case of the young until they have attained the age of twenty-one.

GUARDIAN ANGEL, the angelic guardian who, by some, is supposed to watch over every human being with a view of preserving him or her from moral evil. The notion is based on Gen. xlviii: 16, Matt. xviii: 10, and Heb. i: 14.

GUATEMALA (gwä-te-mä'lä), a republic of Central America; area estimated at 46,800 sq. miles; pop. (1900), 1,574,340. It is in general exceedingly picturesque, and distinguished by a luxuriant and varied vegetation. It is wholly mountainous or elevated, the main chain of the Central American system traversing it southeast to northwest, and sending off numerous branches. Along the main chain are a considerable number of volcanoes, several of which are said to be active—as Fuego and Agua (14,890 feet high), which sends forth torrents of water. The state is well watered by numerous streams, none of much importance. On the table-land, of which a considerable portion of the state is formed, the climate is mild; but in more elevated situations the cold is intense. There is much valuable timber. The soil generally is of great fertility, producing according to altitude, soil, etc., corn, wheat, rice, coffee, cotton, tobacco, sugar, cochineal, cacao, indigo, vegetables, and tropical fruits in great variety. Fiber plants are numerous, including ramie, henequen, and others. The most important product is coffee, and the other chief exports are skins, caoutchouc, cochineal, wool, etc. The trade is chiefly carried on with Britain, the United States, Germany, and France. In the altos or mountainous parts of the northwest considerable flocks of sheep are raised, the wool of which is manufactured into coarse fabrics. Great attention is now being paid to education, the children, even Indians, in small and remote villages being compelled to attend school. The capital is Guatemala la Nueva (New Guatemala). The chief port is San José on the Pacific; Champerico on the Pacific, and Livingston in the Bay of Honduras are the other ports. The legislative power is vested in a national assembly elected for six years by universal suffrage. The executive is vested in a president, elected for four years.—New Guatemala, or Santiago de Guatemala, the capital, is situated about 5000 feet above the sea, and 80 miles distant from the Pacific. Pop. 85,000.—Old Guatemala, the former capital, is 10 miles southwest of New Guatemala. It was founded by the Spanish in 1542, and continued to be the capital till 1774, when it was destroyed by a volcanic outbreak. It has been rebuilt, however, and the population is now about 20,000.

GUAVIARE (gwâ-vi-ä′rā), a river of Colombia, South America, an affluent of the Orinoco; length, 900 miles.

GUAYAQUIL (gwī-â-kēl′), a city and seaport in Ecuador. It is the chief port of Ecuador, and one of the best of the west coast of South America. Its principal exports are cacao, coffee, and ivory nuts. Pop. estimated at 40,000.

GUDGEON, a fresh-water fish, belonging to the carp family. It has short dorsal and anal fins, without spines; on each side of the mouth there is a small barbel; neither jaw is furnished with teeth, but, at the entrance of the throat, there are two triangular bones that perform the office of grinders. These fish are taken in gentle streams, and measure only about 6 inches.

GUELFS or **GUELPHS,** the name of a distinguished princely family which originated in Germany, but was also at one time connected with Italy, and which still flourishes in the two lines of the house of Brunswick, the royal (to which the reigning family in Britain belongs) and the ducal. The first who bore the name is said to have been Welf, the son of Isenbrand, whose grandfather was a vassal of Charlemagne. See Brunswick (Family of) and Guelfs and Ghibellines.

GUERNSEY, (gêrn′zi), the second largest and most western of the Channel Islands, lying off the north coast of France, 46 miles from Cherbourg, and about 68 miles from Start Point in Devonshire. The principal exports are cattle (the dairy cows being renowned), fruits, vegetables in the early spring; granite for paving, etc. Steamers ply regularly between Guernsey and London, Southampton, Plymouth, and Weymouth. It is strongly fortified, and has a well-organized militia. Pop. 35,339. See Channel Islands.

GUERRERO (ger-râ′ro), a state of Mexico; area, 24,227 sq. miles. Its surface is finely diversified by mountain and valley, and partly covered by native forests; and it is rich in minerals, including gold, silver, copper, and iron. The principal port is Acapulco. Pop. 474,594, mostly Indians.

GUERRILLAS (ge-ril′az), a name first given in Spain to light, irregular troops, consisting chiefly of peasants who fought against the invading French in the early part of the present century. The name has now become quite a general term for such irregular troops, and has traveled far beyond Spain.

GUIANA (gī-an′a), British, a colony in the north of South America, about 560 miles long, and about 200 miles broad, having e. Dutch Guiana, w. Venezuela and Brazil, n. and n.e. the Atlantic, and s. Brazil; estimated area, 109,000 sq. miles. It is divided into three settlements—Berbice, Demerara, and Essequibo. The coast tract forms a dreary belt, 10 to 40 miles broad, of mud-banks and shallows, and when drained the surface sinks 1 foot below the sea-level, hence strict attention must be paid to dams and sluices. This alluvial deposit is succeeded by a range of low hills not exceeding 200 feet in height. Gold occurs in various places, and is now mined with success. Rock crystals and red agate are met with; and very white clay is found in the Essequibo. The extensive flats along the shore are composed of alluvial soil and clays, resting upon granite. The chief rivers are the Essequibo, Demerara Berbice, and Corentyn. The climate, though moist and warm, is not on the whole unhealthy. Among the animals are the jaguar, tapir, armadillo, sloth, vampire bat, alligator, etc., and many species of birds, such as humming-birds, parrots, etc. Snakes, some of them

Indians of Guiana.

venomous, and troublesome insects are numerous. Guiana has two dry and two wet seasons, each continuing for three months: The mean annual temperature is nearly 81° 2′. Sugar, rum, and molasses are the principal exports. Pop. (1901), 300,748, of which a great proportion are of African race or coolies from India.

GUIANA BARK, the bark of Cinchona, considered to possess great value as a febrifuge.

GUIANA, DUTCH, or **SURINAM,** a Dutch colony in South America, situated between English and French Guiana; area, about 60,000 sq. miles. Only a small part of the colony is under cultivation. On the Surinam river, about 10 miles from its mouth, is situated the capital, Paramaribo. The principal exports are sugar, coffee, molasses, and rum. The government is vested in a governor-general and council. Pop. 72,533.

GUIANA, FRENCH, a French colony in South America, between Dutch Guiana and Brazil; area, about 35,000 sq. miles. The colony comprises the the island of Cayenne, celebrated for the pepper bearing that name. Gold has also been found in considerable quantities. The French are said to have first settled in Cayenne in 1604. Pop. 30,000.

GUIDON (gī′don), the little flag or standard of a troop of cavalry.

GUIGNET'S GREEN (gē-nyā), a pigment prepared by heating in a reverberatory furnace a mixture of three parts boracic acid and one of bichromate of potassium, made into a thick paste with water. This color is quite fixed—it does not alter by light or reagents, and it is quite harmless, so that it forms an excellent substitute for the greens which contain arsenic and copper.

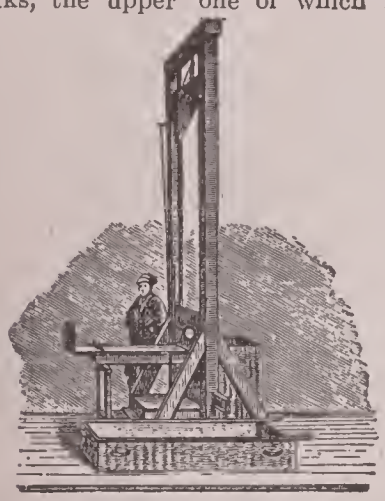
GUILD, a society or association for carrying on commerce, a handicraft, or some other undertaking. Such associations are known from very early times in various countries. The societies of tradesmen exclusively authorized to practice their art, and governed by laws of their own, played a very important part in the middle ages. They often formed a bulwark against the oppression of the nobility, and were thus extremely conducive to the growth of municipal and civil liberty. Traces of these trade societies are found in the 10th century. In Milan we find the mechanics united under the name credentia. At Florence the trades were federated into twenty-one guilds or arti. These originated in 1282, on the overthrow of the nobility, and every candidate for citizenship was obliged to enter some particular guild. With the view of destroying the political influence which they had acquired the emperor Frederick II. abolished them by a decree issued in 1240; but the decree remained without effect, as did also the clauses inserted with a similar view into the Golden Bull in 1356, and it was not until the present century that unrestricted freedom to practice any trade was established in the German states. In Austria this was done in 1860, and in 1868 it was done for all the states of the North German confederation. In Britain trade guilds long possessed an importance which was mainly political. As the right of voting was involved in the membership of a guild, many persons, not mechanics, acquired the rights of "freemen" by connecting themselves with some body of this kind. These guilds, in England, had no legal right to prevent any man from exercising what trade he pleased. The only restriction on the exercise of trades was the statute of Elizabeth, requiring seven years' apprenticeship. This the courts held to extend to such trades only as were in being at the time of the passing of that statute; but by an act passed in 1835, every kind of restriction on artisans, trades, etc., was abolished. The guilds or companies of the city of London (among the oldest of which are the weavers, founded in 1164; the parish clerks, in 1232; the saddlers, in 1280, the fishmongers, in 1284) are still very important corporations, which give relief to poor and decayed members, and also manage vast funds bequeathed for benevolent purposes. Besides the secular guilds there were from a very early period, in Britain, religious guilds. The property of the religious guilds was sequestrated in the reign of Henry VIII. In France guild-privileges were sold by the state from the 10th century till the revolution of 1789, but at that date guilds were entirely abolished. This was done also at a later period in Belgium, Holland, Italy, Sweden, and Denmark. Many of the trades-unions have now somewhat of the character of the ancient guilds.

GUILDHALL, the city hall of London, Cheapside, first built in 1411, all but consumed in the great fire of 1666; and in 1669 rebuilt. The front was not erected until 1789. The most remarkable room is the hall, 153 feet long, 48 broad, and 55 high, used for city feasts, etc. It contains the curious wooden statues of Gog and Magog. In the common-council room is a collection of pictures, some of them very valuable. There is also a library in the Guildhall.

GUILLEMOT (gil'e-mot), a name for several web-footed birds belonging to the family of auks. The guillemots have a straight, compressed, and pointed bill, covered with feathers as far as the nostrils, and have no hallux or hind-toe. The wings are pointed and very short, the legs also short, and placed far back. They live on fish, and build on precipitous rocks adjoining the sea.

Black guillemot.

GUILLOTINE, (gil-lo-tēn'), an engine for beheading persons at one stroke—an invention of the middle ages—adopted with improvements by the national assembly of France during the first revolution on the proposal of a Dr. Guillotin, after whom it is named. In this apparatus decapitation is effected by means of a steel blade loaded with a a mass of lead, and sliding between two upright posts, grooved on their inner sides, the person's neck being confined in a circular opening between two planks, the upper one of which also slides up or down. The condemned is strapped to a board, which in the cut is shown resting horizontally on the table in front of the upright posts, but which is easily drawn forward and set upright when necessary, and again canted over upon the table and rapidly moved up so as to place the neck of the condemned within the semicircle of the lower plank, the other being raised for the purpose. On the right of the table is a large basket or trough of wicker-work for the reception of the body. Under the place where the head rests is an oblong trough for its reception. The knife is fixed to the cap or lintel on the top of the posts by a claw in the form of an 8, the lower part of which opens as the upper closes. This claw is acted upon by a lever to which a cord is attached. When the head of the condemned is in position the cord is pulled, and by the action of the lever the knife is set at liberty, descending by the grooves in the upright posts and falling upon the neck of the condemned just behind the planks which keep the head in position. The scaffold, which is surrounded by an open railing, is raised 6 or 7 feet from the ground. The same name is given to a machine which cuts by a knife descending between grooved posts, much used for cutting paper, straw, etc.



Guillotine as used in Paris.

GUINEA (gin'ē), a geographical division of Western Africa, including the Atlantic coast-line and an indefinite area of the interior between the frontiers of Senegambia and Cape Negro, or Cape Frio (where German territory now begins). It is divided into two districts, lying north and south of Cape Lopez: the former, called Upper Guinea, includes Sierra Leone, Liberia, the Grain, Ivory, Gold, and Slave coasts, parts of Nigeria, German Cameroon territory, etc.; the latter, called Lower Guinea, includes part of French Congo, Angola, etc. See Africa, and the separate articles.

GUINEA, Gulf of, that portion of the Atlantic which washes the shores of Upper Guinea, between Cape Palmas and Cape Lopez, and including the bights of Benin and Biafra. The islands of Fernando Po, Prince's, and St. Thomas, are within this gulf.

GUINEA, New. See New Guinea.

GUINEA-CORN, a name given to durra, one of the grains also called millet. In the United States it is cultivated under the name of broom-corn.

GUINEA-FOWL, or **PINTADO,** a genus of pheasants, originally all natives of Africa. The common guinea-fowl, now well known as a domestic fowl, has a slate-colored plumage varied with round white spots. It is about the size of a common fowl, and is of a noisy and quarrelsome disposition. Its eggs are esteemed.

Guinea-fowl.

GUINEA-GRASS, a very tall species of grass, a native of Africa, of the same genus with the millet, often 6 and sometimes even 10 feet in height. It has been naturalized in South America and the West Indies, and largely cultivated for fodder. It does not perish even in Britain, but there it is not so productive as in warmer climates.

GUINEA PEPPER, a lofty tree of the same family with the custard apple. Its fruit, consisting of dry carpels, is used as pepper, "negro pepper." The term Guinea Pepper is often used as an equivalent for Grains of Paradise, or Malaguetta. See Caspsicum.

GUINEA-PIG, a well-known rodent mammal. It is a native of South America and resembles the pig only in its grunting voice. It is a timid little animal, extremely prolific, and it feeds on vegetables, especially parsley, bread, grain, etc. It is very destitute of intelligence.

GUINEA-PLUM, the fruit of a West African tree, growing to the height of 60 feet.

GUINEA-WORM, a parasitic of the thickness of pack-thread, somewhat attenuated at the hook-shaped posterior extremity. It varies in length from 6 inches to several feet, and it is found in the intertropical regions of the Old World.

GUIPUZCOA (gē-puth'ko-â), one of the three Basque provinces, in the n. e. of Spain, bounded n. by the Bay of Biscay; n. e. by France; area, 728 sq. miles. Pop. 195,850.

GUISCARD (gis-kär), Robert, Duke of Apulia and Calabria, a son of Tancred de Hauteville, born in 1015. His brothers, having acquired large possessions in Italy, Robert followed them about 1053 and in the same year captured Pope Leo IX. at Civitella. On the death of his brother Humphrey he was proclaimed count of Apulia in 1057. He then conquered Calabria, and Pope Nicholas II. made him gonfalonier of the Church. In 1074 he was excommunicated by Gregory VII. for refusing to become his vassal, but the ban was removed in 1080. As his daughter Helen was betrothed to the son of the Byzantine emperor, Michael VII., Guiscard, on the latter's deposition, took up arms in his favor, and defeated Alexis Comnenus at Durazzo (1082). He was upon the point of advancing against Constantinople, when he died in the island of Cephalonia in 1085.

GUISE (gwēz), a distinguished ducal family of France, a branch of the house of Lorraine. The founder was Claude, a son of René II., duke of Lorraine, who in 1506 became naturalized in France. In his favor the county of Guise was erected in 1528 by Francis I. into a duchy. He died in 1550, leaving behind him five daughters (the eldest of whom, Marie, married James V. of Scotland, and was the mother of Mary, queen of Scots) and six sons—François, who succeeded him, Charles (Cardinal of Lorraine), Louis (Cardinal of Guise), Claude, François, and René. The family acquired great political importance on the accession of Francis II., who was married to Mary, queen of Scots. The direct line became extinct in 1675. In 1704 the title was revived for the house of Condé.—Two of the dukes require particular mention.—François de Lorraine, the second duke, born in 1519, early distinguished himself in war, especially at Metz, which he defended with success against Charles V., and at the battle of Renti, 1544. In his Italian expedition (1556–57) he failed to conquer the kingdom of Naples. But he was successful in that which resulted in the final annexation of Calais to France. Under Henry II. and Francis II. he was the virtual ruler of France. On the death of Francis II. the factions of Condé and Guise arose, the Protestant, (Huguenots) being on the side of the former, the Catholics on that of the

latter. When civil war broke out the Duke of Guise took Rouen and Bourges, and won the battle of Dreux in 1562. He was preparing for the siege of Orleans, the central point of the protestant party, when he was assassinated by a Huguenot nobleman, Feb. 1563. He left memoirs written by himself.—Henry, third duke, eldest son of the preceding, was born in 1550. He was a bitter opponent of the Huguenots, and fought against them at Jarnac and Moncontour, and advised the massacre of St. Bartholomew (1572). From revenge he personally conducted the assassins to the house of Coligny. In 1576 was formed the catholic league, first projected by his uncle, the Cardinal of Lorraine. A period of civil war followed, the party of Guise proved too strong for his opponents, and having brought about a rising of the catholics in Paris (May, 1588), he entered the city in triumph. He might now have made himself master of the throne, but negotiations were set on foot, and the duke's displays of imprudent ambition led to his assassination in the king's cabinet, Dec. 23, 1588, at Blois, whither the states had been summoned in order finally to ratify the treaty that had been arranged.

GUITAR (gi-tär'), a stringed instrument with a hollow body, and a neck somewhat similar to that of a violin, used especially to accompany the voice. The modern or Spanish guitar has six

1, French guitar of 17th century.
2, Modern guitar.

strings, the three highest of gut, the three lowest of silk covered with fine wire, tuned respectively to the E in the second space of the bass staff, A its fourth, and the treble D, C, B, and E. The intermediate intervals are produced by bringing the stirngs, by the pressure of the fingers of the left hand, into contact with the frets fixed on the keyboard, while those of the right pluck or switch the strings. It is extremely popular in Spain. The Spaniards derived it from the Moors, who brought it from the east.

GUIZOT (gē-zō), François Pierre Guillaume, French historian and statesman, born at Nimés, 1787, died 1874. In 1812 he married Mdlle. de Meulan, editor of the 'Publiciste, and became professor of history at the Sorbonne. In 1816 he published Du Gouvernement Représentatif et de l'Etat Actuel de la France, and Essai sur l'Instruction Publique. In 1820 the Duc de Berry was assassinated, and Guizot's party fell before an ultra-royalist reaction. In 1825 he was deprived of his chair on account of the political character of his lectures, but it was restored to him in 1828. In 1829 he again became councillor of state, and in 1830 was elected deputy for the arrondissement of Lisieux. After the July revolution he was appointed minister of the interior, but resigned in 1831. After the fall of Louis Philippe, Guizot escaped and fled to England. Henceforth he practically retired from public life. Among his numerous works may be mentioned Histoire de la Civilisation en France, Histoire Générale de la Civilisation en Europe; Histoire de la Révolution d'Angleterre; Washington; Discours Sur la Révolution d'Angleterre; Méditations et Etudes Morales; Guillaume le Conquérant; Mémoires pour Servir à l'Histoire de Mon Temps (1858–68); Méditations sur l'Etat Actuel de la Réligion Chrétienne; Mélanges Biographiques et Littéraire; Histoire de France, Racontée à Mes Petits Enfants, etc.

GUJERAT, GUJARAT, or **GUZERAT,** a maritime province in Western Hindustan, presidency of Bombay; total area, 70,000 sq. miles; pop. 11,000,000. Gujerat comprises a number of native states within its area, the chief being the scattered territories of the Gaekwar or Guicowar of Baroda. The population presents an extraordinary assemblage of sects and castes. It gives name to the vernacular language of Northern Bombay—Gujarati. The area of the British portion, comprising the districts of Surat, Broach, Kaira, Panch Mahals, and Ahmedabad is 10,158 sq. miles, and the pop. 3,098,197.

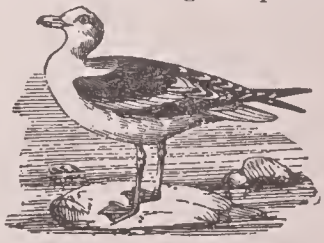
GUJRANWALA, a town of India, in the Punjab, administrative headquarters of district of same name. It has inconsiderable manufactures of country wares, such as brass vessels, etc. Pop. 29,224.—Area of district, 3017 sq. miles. Pop. 690,169.

GUJRAT, a district of India in the lieutenant-governorship of the Punjab, in the Rawal Pindi division between the Jehlam and the Chenab. Pop. 760,875. —Gujrat, the capital, 5 miles from the Chenab, is a commercial center. Its manufactures are principally of cotton and of Gujrat ware, that is inlaid work in gold and iron. Pop. 18,743.

GULF STREAM, one of the most celebrated of the oceanic currents, so called because it issues from the Gulf of Mexico. It owes its origin to the fact that the westward-moving waters of the tropical portion of the Atlantic, encountering the eastward projection of South America, become divided into two currents, one setting southward along the Brazilian coast, and the other northward past the mouths of the Amazon and Orinoco, into the Caribbean Sea. It then enters the Gulf of Mexico, and thence emerges through the Channel of Florida as the Gulf Stream. Its course is next to the north and eastward, in a direction parallel to the coast of the United States, past Cape Hatteras (lat. 35° 13′), along the southern edge of the "great banks" of Nantucket and Newfoundland (between the meridians of 48° and 60° west), after which its course as a distinct current cannot be traced. In the earlier part of its course, especially when rounding the extremity of Florida, the Gulf Stream forms a well-defined current, distinguished by its high temperature and its deep blue or indigo color. On account of the descent of the polar or Baffin Bay current along the coast in a direction opposite to that of the Gulf Stream, the water on its inland side is colder than that to the eastward of it. The difference of temperature between the Gulf Stream and this cold current sometimes amounts to 20° (or even 30°) Fahr. The velocity of the Gulf Stream varies with its course. Within the Florida Channel it attains a mean of 65 miles per day, this sinks to 56 miles off Charleston, becomes 36 miles to 46 off Nantucket, and 28 miles to the south of the Newfoundland banks; 300 miles to the eastward of Newfoundland its movement is hardly perceptible. At the bottom of the Flordia Channel the observed temperature is 34°, that of the surface from 80° to 84°. Geographers have greatly exaggerated the influence of the Gulf Stream on the temperature of Europe. If it possesses any direct influence such must be extremely small, as the current is both too narrow and too shallow, and its slight amount of superior heat probably vanishes after it has passed Cape Hatteras. The relatively high temperature of western and northwestern Europe must rather be referred to the general set of the tropical waters to the northeast, and to the warm winds blowing in the same direction, and not to the Gulf Stream exclusively.

GULF-WEED, a genus of sea-weeds which grows on tropical coasts, and accumulates in great floating beds, but does not propagate when detached.

GULL, the general name of a family of birds distinguished by their straight bill, bending downward toward the point, and marked below the under mandible by a triangular prominence,



Lesser black-backed gull.

by their large wings, slender legs, palmated feet, and small hind toe. Generally seen in large flocks, the larger species frequent the sea, the smaller, lakes or rivers. They swim well, but are incapable of diving. Their flight is rapid and long sustained. They are extremely voracious, and feed on every kind of animal food, putrid or fresh. Their principal food is fish, which they catch with great agility, darting down like an arrow. They breed only once a year, laying two to four eggs. The species are exceedingly numerous, and resemble each other greatly. Among the principal are the common gull which breeds on the coast, or inland in moory districts; the lesser black-backed gull, the black-headed gull, the ivory gull, the Iceland gull, distinguished by its white quill feathers from the herring gull, the great black-backed gull; the burgomaster; the little gull; sabine's gull; the kittiwake, etc.

GUM, a substance of various properties which exudes spontaneously from

the bark of certain trees, such as the plum, the peach, etc.; or from incisions made in the bark to facilitate the flow. Gums form non-crystalline rounded drops or tears, the purest varieties being transparent or translucent, of a pale yellow but sometimes of a dark color. When dissolved in water gum forms a thick, smooth fluid, with considerable viscosity. Some gums, such as gum-arabic, dissolve in water; others, like tragacanth, are only partially soluble; they are insoluble in alcohol. By being insoluble in alcohol gums are distinguished from resins. They have no odor, and only a very faint taste. The different kinds of gums receive their names from the countries from which they are imported—such as gum-arabic, gum-senegal, Barbary gum, East India gum, etc., and from individual features, as cherry-tree gum, tragacanth, etc. Gum-resins require water and alcohol to dissolve them. See Gum-resins.

GUM-ARABIC, is the purest form of gum, and may be regarded as typical. It comes from various species of Acacia. The gum exudes spontaneously, and its appearance is an indication of the tree being in an unhealthy condition; but in order to get it in sufficient quantity incisions are made in the bark. Gum-arabic is very largely employed in the finishing and dressing of fabrics; for thickening the colors in calico-printing; in pharmacy; as a cement; in ink-making; for making crayons and water-color cakes, and for many other purposes. The purest gum-arabic is in round tears, transparent, and almost colorless, faintly odorous, completely soluble in water, the solution being feebly acid.

GUM-BOIL, an abscess in the gum generally the result of toothache or of the presence of decayed teeth or stumps. The carious tooth or stump, if the inflammation proceeds from this cause, should be removed. The purulent matter should be evacuated by a free incision, and the mouth frequently washed with tincture of myrrh and water.

GUM-ELASTIC, caoutchouc or india-rubber.

GUM-JUNIPER, the resin of a coniferous tree of Barberry, used in varnish etc.

GUMMING, a disease of certain fruit-trees, as cherries, plums, apricots, peaches, etc., consisting in a morbid exudition of gum, and generally resulting in the death of the tree.

GUM-RESINS, solidified juices obtained from plants. They contain a gum, which is soluble in water, and a resin, which dissolves in spirit, so that the body usually is nearly quite soluble in dilute alcohol; but there are usually present in addition essential oil, and a variety of impurities. The gum-resins have frequently a strong and characteristic taste and smell. They are solid, opaque, and brittle. The common gum-resins are aloes, ammoniacum, asafœtida, bdellium, galbanum, gamboge, myrrh, olibanum, opoponax, sagapenum, and scammony.

GUN, a missile weapon, causing destruction by the discharge of a ball, bullet, or other substance, through a cylindrical tube, along which it is propelled by the action of gunpowder or other explosive substance. One of the famous guns of history is the great "Mons Meg," which was made at Mons, Brittany, in 1486, and which was burst in 1682 while firing a salute. It was made of iron bars, hooped together. Another is the "Tsar Cannon," or "King of Cannons," preserved in the Kremlin at Moscow. Other noted guns are the Turkish pieces guarding the Dardanelles, the gun at Dover, an inscription on which says:

"Load me well and keep me clean
And I'll land a ball at Calais green."

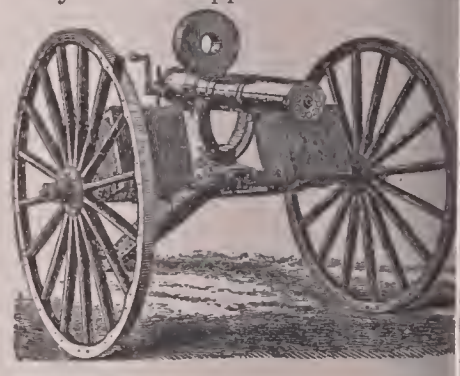
In recent times progress has been made by the improvement of the breech-loading method, in the method of rifling, and in the size of ordnance, particularly the monster guns made by the Krupp company at Essen, Germany. Machine guns of the Gatling type were introduced half a century ago, and the first automatic gun was devised by Maxim, on the principle of using the recoil to reload and fire. See Cannon, Rifle, Machine-gun, etc.

GUN-BOAT, a term applied to small war-vessels mounting often only a single heavy gun, and employed in coast defense or in attacking large and heavy-armored vessels. Some gun-boats have their one gun on the deck mounted so as to be turned in any direction by means of a pivot. In others the single gun is placed on a platform, which can be raised to the deck or lowered to the hold. The gun in this case does not turn on a pivot, the manœuvring being effected entirely by the turning of the vessel. Some of the gun-boats of the present day are armed with several powerful breech-loading guns besides quick-firing and machine guns; and they may also be fitted for discharging torpedoes. Many of them are very swift.

GUN-CARRIAGE, the structure on which a cannon is mounted, and on which it is fired. Gun-carriages are of very various constructions. In the case of a field or siege piece the carriage is united, for traveling, with a two-wheeled fore-part, termed a limber, to which the horses are attached, so as to form a single four-wheeled carriage. In action the gun is unlimbered, and then rests on its pair of wheels, and on a strong support termed the trail. A gun in a fortress has its carriage commonly mounted on what is termed a traversing platform, that is, a strong framework supported on metal trucks or small wheels. In mortars a cast-iron bed takes the place of a carriage.

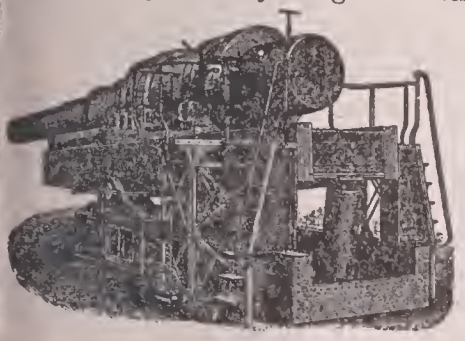
GUN-COTTON, or Pyroxyline, is an explosive substance formed by the action of nitric acid on cotton. In the process of manufacture sulphuric acid is mixed with the nitric, its function being to absorb the water formed by the weakening of the nitric acid as it gradually combines with the cotton. The product of this process is a chemical compound of four or five times the explosive power of gunpowder. The cotton is generally reduced to a finely divided condition, and the gun-cotton moulded into disks of suitable sizes. When ignited in a free state it burns with a strong flame; it is only when fired by a detonating fuse or when heated in confinement that it explodes. The presence of water and other substances does not interfere with this kind of explosion. From this follows the important fact that it can be kept wet with safety while in a condition in which it may be exploded by means of a detonator. In short, when wet it is quite safe and yet quite ready for work at a moments notice; for, while it refuses to burn even in the heat of a powerful flame, the application of a large or of a small detonator inserted in one dry disk of gun-cotton causes the wet mass to explode with its full violence. Bursters of gun-cotton and water have been used in shells for certain purposes. When exploded it produces little smoke and a very small amount of residual matter. There are also preparations allied to gun-cotton with wood-fiber as a basis, such as Schulze's powder, sawdust powder, etc. An imperfect chemical form of gun-cotton termed collodion, soluble in a mixture of ether and alcohol, is used in photography.

GUNNERY, the science of conducting the fire of artillery. Gunnery may be divided into the theoretical and practical branches. The former consists chiefly in the application of mathematics to the solution of the problems in dynamics involved in the consideration of the motion of shot through the air, and is essential to the design of good systems of rifling and well-proportioned projectiles. Practical gunnery, which deals with the actual firing, has reference rather to the use of individual guns than to the handling of artillery on a large scale. Theoretical gunnery would be simple were the projectiles fired in vacuo, as gravity alone would, in such a case, require to be taken into account, and the path of projectiles would simply describe a parabola. The line taken by a projectile (or its trajectory as it is called) is, however, subject to modifications caused by the resistance of the air, the form of the shot, etc. Among things to be considered in gunnery are the velocity of the projectile, initial and subsequent, the angle of elevation of the piece, the range or distance to which the projectile is carried, etc. With cast-iron spherical shot the chief complication arises from the centre of gravity never falling exactly in the centre of the figure. Rifled guns, however, fire projectiles with a certain known rotation, and in



Gatling gun.

ase of elongated shot, these are more ccurately centerd in the bore by the ction of the grooves, and possess the aculty of traveling point first, and of hus overcoming the resistance of the ir. One mechanical disadvantage be- ongs to rifled shot—namely, the wild rregularity of their ricochet—a dis- dvantage which, however, does not pply to shells burst on the instant of raze by percussion fuzes, or before con- act by time fuzes. All the British serv- ce projectiles have their centres of ravity nearly half way along their axes,



Krupp's 15.6 breech-loading gun. Breech open.

nd in flight they carry toward the ight hand of the person laying the gun —a species of deviation to which the ame of drift or deflexion is given. In letermining the velocity of projectiles arious instruments are used. Among hese are Wheatstone's electromagnetic hronoscope, the Bashforth chrono- raph, the Noble chronoscope, etc. In rdinary artillery fire the charge is a ixed one, and the elevation is varied ccording to the range. Horizontal fire gainst the front of a column or line of vorks is termed direct fire; that which weeps along a line of men or earth- vorks, enfilade fire; vertical fire is when he piece is fired at a high angle of eleva- ion.

GUNNY-BAGS, are bags made of a oarse cloth or sacking manufactured in ndia of some native fiber, chiefly jute. hey are extensively used in India in acking rice, sago, spices, etc., for ex- ort, and in America for bales of cotton.

GUNPOWDER, is a mixture of salt- eter, sulphur, and charcoal. We hear f gunpowder from a very early period. t appears to have been used in China t, if not before, the Christian era. Marcus Græcus, who lived about the th century, describes its composition, which was also known to Roger Bacon, who refers to it in 1267. It was also pparently known to the Arabs at an arly period. In 1342 the Moors em- loyed it in the siege of Algesiras. According to the common story the liscovery of its propulsive power was lue to the German monk Barthold Schwartz between 1290 and 1320. Guns re said to have been employed by Edward III. in 1327, on his invasion of Scotland. It is also asserted that gun- owder was employed in 1346 by the English at Crécy. It was not, however, ntil the 16th century that its use in varfare became general. The propor- ion of the ingredients in the composition f gunpowder is different in different ountries. In Britain the proportions or different kinds, such as sporting and mining powders, differ slightly. The gunpowder of the mills at Waltham Abbey contains 75 saltpeter, 15 char- coal, and 10 sulphur. The crude salt- petre is dissolved in an equal weight of boiling water in a copper boiler, filtered, and allowed to cool and crystalize in a trough in order to purify it from nitrates of soda and lime, chlorides of potassium and sodium, etc., the liquid being con- tinually agitated, so that the crystals may be formed small and pure. They are then washed and allowed to drain. The sulphur is purified and ground. The charcoal is obtained from alder or willow wood, or from dogwood for the finest powder. These ingredients are first roughly mixed, then sprinkled with water and incorporated under rollers in a mill, and formed into a cake termed "mill cake." This is broken up under grooved rollers, and brought by pressure into "press cake." After this it is gran- ulated, by being passed between toothed rollers, and separated into classes by sieves of different sizes of mesh. Latterly a very large grain has been adopted for the heaviest charges; this is termed pellet or pebble powder. "Pellet" powder is made by filling the cylindrical holes in a thick gun-metal plate with mealed powder, and by means of pistons under a hydraulic press, forming them into short cylinders or "pellets," with a small cavity at one end to catch a flame the more readily. "Pebble" powder is made by cutting or pressing edges which divide the press cake into small cubes; these, like pebbles, have their corners rubbed off and rounded by friction. The largest pebble powder consists of cubes of 1½ inches. There is also a gun- powder known as "prismatic," the grains forming large hexagonal prisms with a hole through the center. "Cocoa" powders are made with other kinds of carbon than wood charcoal. Smokeless powder has been introduced ("cordite" may here be named), but has not yet been properly tested in war. Gun-cotton is the base or an important ingredient of all the well-known smokeless powders. As it is necessary that the flame must traverse the interstices between the grains of powder, the grains must be suited to the size of the charge of the gun. The greatest precautions must be taken to prevent fire or water from com- ing into contact with gunpowder. Hence it is usually kept in magazines which are of great strength in defensive works, although lighter and well-ventilated buildings suffice under other conditions. In the transportation of gunpowder, the casks should be dust-proof, and the carriages and vessels containing it should be water-tight. As iron vessels are dangerous, gunpowder is usually packed in copper-hooped barrels made with copper nails. The explosive powder of gunpowder is very great. It is, how- ever, necessary to place it within a con- fined space, as, when it is heaped up in the open air, it explodes without report or much effect. As the result of experi- ments it appears that the weight of the gases produced by inflaming gunpowder is about $\frac{6}{10}$ths of that of the powder, and their volume 288 times its bulk, when they have attained an elasticity equal to that of the air. If the effect of heat evolved during the combusiton be added, the elastic force is increased to 1000 atmospheres in round numbers, i.e. a pressure of about 6½ tons to the sq. inch.

GUNPOWDER PLOT, a conspiracy formed in England in 1604, the second year of the reign of James I., by some Roman Catholics, to blow up the king and parliament in order to be revenged on the government for its severities against their religion. The time ulti- mately fixed for the execution of the plot was the 5th of November, 1605, when parliament was to be opened by the king in person. The plot originated with Robert Catesby, Thomas Winter, and John Wright, and was at once made known to Guido Fawkes, a zealous Catholic, who had served in the Spanish army in Flanders, and to Thomas Percy, a relation of the Earl of Northumberland. The plot was subsequently communi- cated to Sir Everard Digby, Ambrose Rookwood. Francis Tresham, Thomas Keyes, and to some Jesuit fathers and others. Fawkes, Rookwood, Winter, and others were tried at Westminster on 27th of Jan., 1906, and executed on the 30th and 31st.

GUNTER'S CHAIN, the chain in com- mon use for measuring land; so called from its inventor, Edmund Gunter. Its length is 66 feet, or 22 yards, or 4 poles of 5½ yards each; and it is divided into 100 links of 7.92 inches each. 100,000 square links make 1 acre.

GUNTER'S SCALE, a scale having various lines upon it, of great use in working problems in navigation. This scale is usually 2 feet long and about 1½ inches broad. On the one side are the natural lines, and on the other the artifi- cial or logarithmic ones.

GUR'NARD, or **GURNET,** the popular name of acanthopterous fishes. The head is angular, and wholly covered with bony plates. The body is elongated, nearly round and tapering; there are two dorsal fins; the pectoral fins are large; the teeth are small and numerous.

GUSTAF V. GUSTAF, Adolf, King of Sweden, son of Oscar II., was born in 1857. He was trained for the army and has been inspector general of the mili- tary schools of Sweden. In 1881 he married Princess Victoria of Baden, a cousin of Emperor William of Ger- many. He became king in 1907, on the death of his father, Oscar II.

GUSTA'VUS I., commonly called Gustavus Vasa, was born in 1490, or, according to others, in 1496. He roused the peasants to resist Danish oppression, defeated the Danes, took Upsala and other towns, and in 1523 was elected king. In 1529 he procured the abolition of the Roman Catholic religion in Sweden, and established Protestantism. He died in 1560.

GUSTAVUS II., Gustavus Adolphus, King of Sweden, a grandson of Gustavus Vasa, was born in 1594. He was trained to war under experienced generals, took his place in the state councils at the age of sixteen, and was in command of the army in his seventeenth year during the war with Denmark, which was concluded in 1613, and by which Sweden recovered important possessions on the Baltic. He

then turned his arms against the Russians, drove them from Ingria, Karelia, and a part of Livonia, which were secured to him by the peace of Stolbova in 1617. After taking many fortified towns, repeatedly defeating the imperial generals, at Leipzig (1631), Würzburg (1631), Passage of the Lech (1632), and conquering a great part of Germany, he was killed in the battle of Lützen, against Wallenstein, 16th November, 1632. (See Thirty Years' War.)

GUSTAVUS III., King of Sweden, born in 1746, succeeded his father, Adolphus Frederick, in 1771. In 1788 he took command of the army against Russia and Denmark, and stormed the defenses of Frederickshall, destroying a great number of vessels. On the outbreak of the French revolution he made strenuous exertions to form a coalition between Russia, Denmark, Sweden, and Spain, but while preparations were making a conspiracy of the nobles was formed against him, and he was shot at a masquerade by Ankarstroem, a disbanded officer, on 16th March, 1792. He died on 29th March.

GUSTAVUS IV., (Adolphus), King of Sweden, was born on 1st November, 1778, and succeeded his father, 29th March, 1792. After the Peace of Tilsit he exposed himself to a war with Russia while he was at war with France, by

Gustavus Adolphus, King of Sweden.

refusing to join the continental blockade and opening his ports to England; and in 1808 he quarreled with England, his only ally. Finland was lost to Sweden, and in 1809 a revolution took place. Gustavus was dethroned, and his uncle, the Duke of Sudermania, proclaimed king under the title of Charles XIII. Gustavus died February 7th, 1837.

GUTENBERG, Johan, the reputed inventor of printing with movable types, was born at Mayence or Mainz, about the end of the 14th century. In 1850 he formed a copartnership with Johann Fust, and established mainly with the money of the latter, a press, in which the Mazarin Bible, the Letters of Indulgence and the Appeal against the Turks were printed. After five years this connection was dissolved, and Fust sued Gutenberg for large advances which he could not pay, and by a judgment at law obtained possession of most of the printing materials, with which, in company with his son-in-law Schöffer, he continued to print books. After this, according to some, Gutenberg carried on a separate printing establishment; but this is doubtful, and there is no book or printed matter which can certainly be ascribed to Gutenberg after the date 1454. Gutenberg seems to have died at Mainz in 1468.

GUTHRIE, the county seat of Oklahoma Territory and of Logan co., on the Cottonwood river and on the Atch., Topeka and S. Fé, Eastern Oklahoma, and Chicago, Rock Island and Pacific railroads. Pop. 12,160.

GUTTA-PERCHA, (pêr'cha; Malay name, meaning "gum-tree"), a substance resembling caoutchouc in many of its properties, but stronger, more soluble, and less elastic. It is the inspissated milky juice of trees of the nat. order

Sprig of gutta-percha tree.

Sapotaceæ. It chiefly comes from Malacca, Borneo, and other islands of the Indian Archipelago. When pure, gutta-percha is of a brownish-red color. Below the temperature of 50° it is as hard as wood and excessively tough. By an increase of heat it becomes more flexible, until at a temperature of 115° F. it becomes pasty, and between this and 140° or 150° it may be moulded into all varieties of forms with the greatest ease, retaining precisely the same form as it cools and hardens to its previous state of rigidity. It is insoluble in water, soluble with difficulty in ether and other caoutchouc solvents, but very readily in oil of turpentine and naphtha. It is not attacked by solutions of alkalics nor by hydrofluoric acid, but it is acted on by sulphuric, nitric, and hydrochloric acids. Gutta-percha has been applied to a variety of purposes: as a substitute for leather, especially in the soles of shoes, etc., as an insulating coating for the copper wires of submarine telegraph cables, as an ingredent in mastics and cements, for the manufacture of flexible hose-tubes, bottles, etc.

GUY OF WARWICK, an old English metrical romance, whose hero is an Anglo-Danish knight said to have been the son of Siward, baron of Wallingford, to have become Earl of Warwick, and to have slain in single combat the Danish giant Colbrand, the Dun-Cow of Dunsmore, and the dragon of Northumberland, and many other wonderful feats. He is said ultimately to have become a hermit in Warwick.

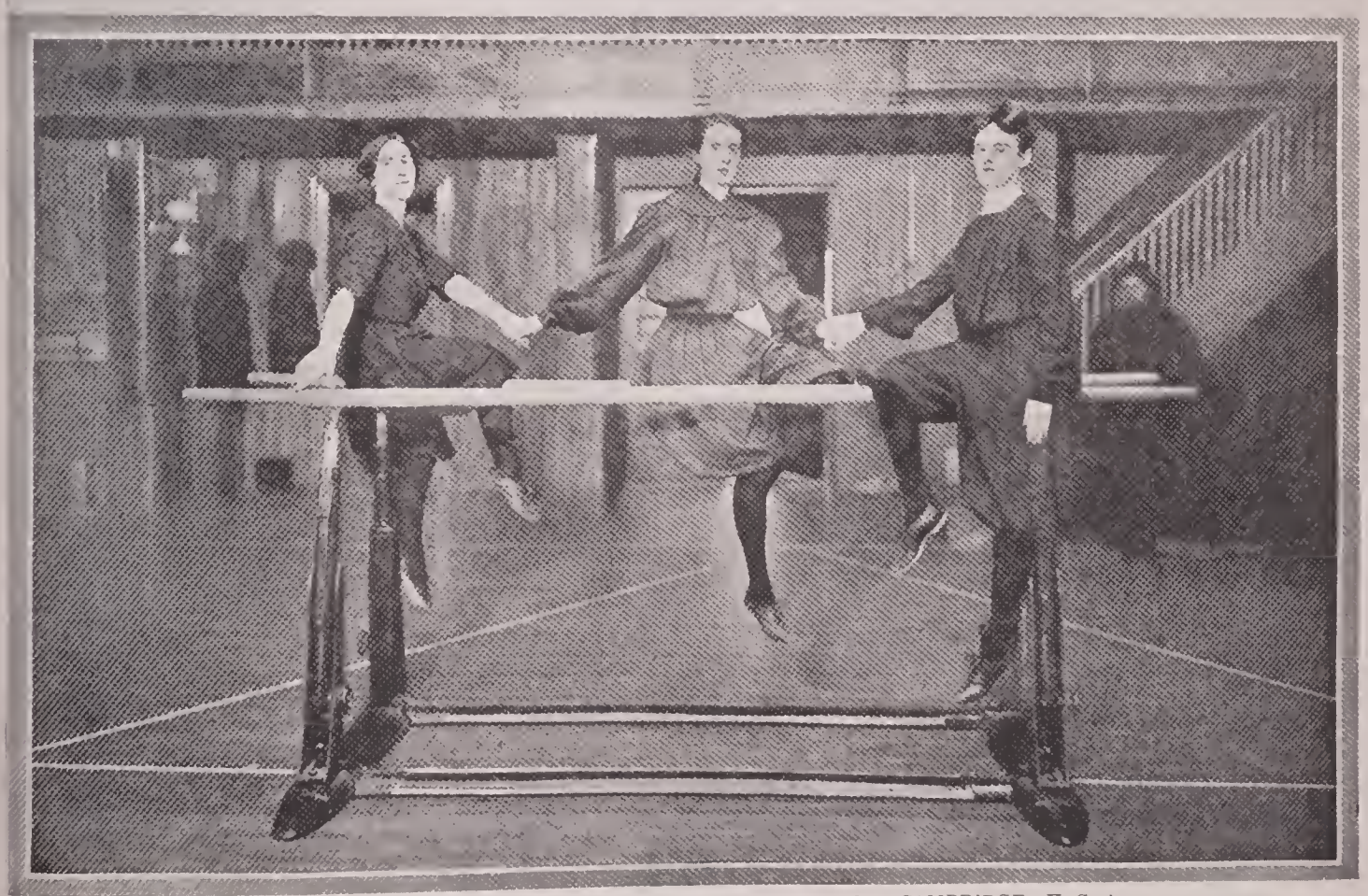
GUYOT (gē-yo), Arnold, geographer and physicist, born in Switzerland in 1807, died in the United States in 1884. He studied theology at Berlin, then took up natural science, and became professor of history and physical geography in the Academy of Neufchâtel. He shared in Agassiz's investigations of glacier phenomena of the Alps. In 1848 he emigrated to the United States and delivered lectures in Boston, which afterward appeared under the title Earth and Man. He rendered much service to meteorological science in connection with the Smithsonian Institution, and traveled extensively in the United States. In 1855 he was appointed professor of geology and physical geography in the College of New Jersey, Princeton.

GWAL'IOR, a city and fortress of Hindustan, capital of the state of Gwalior, situated 65 miles south from Agra. The fortress is the largest, the strongest, and the most magnificent in India. It stands on an isolated rock about 350 feet high and nearly perpendicular in the upper part. The fortress contains wells and reservoirs of water, and is inaccessible except by steps up the side of the rock. Old Gwalior, the town at the northern angle of the base of the rock, built of stone, and has some remarkab

The Fortress of Gwalior.—From an original sketch.

TO STRENGTHEN THE DORSAL MUSCLES

AN EXERCISE WITH A BALL



GIRLS ON PARALLEL BARS AT RADCLIFFE COLLEGE, CAMBRIDGE, U. S. A.

THE MAKING OF STRONG AND HEALTHY CITIZENS—EXERCISES TO PERFECT DIFFERENT MUSCLES

In the first picture a squad of youths is seen exercising the abdominal and dorsal muscles by means of the leg leverage. In the right hand picture it shows a football being passed down the line, each man giving it an impetus. The larger picture illustrates the increasing popularity of gymnastics with girls

ruins of temples and an interesting example of old Hindu palace architecture. Pop. about 25,000. The new town, known as New Gwalior or Lashkar (the camp), the residence of the ruler, Maharajah Sindhia, has sprung up recently on the southeastern skirt of the rock, but is already a flourishing city with a population of 89,154, of whom the majority are Hindus.—The state of Gwalior, in political relationship with the government of India, consists of several portions of territory, otherwise known as Sindhia's Dominions, the largest and most compact portion, usually known as Gwalior, being the one containing the above town and fortress. The total area of Gwalior is 29,067 sq. miles. Gwalior is not as a whole very fertile; one of its most notable products is opium. The drainage is chiefly taken by the Chambal. Pop. 3,525,233.

GWYNN, Eleanor, better known by the name of Nell, a celebrated mistress of King Charles II., was at first an orange girl, and also gained her bread by singing from tavern to tavern. About 1667 she became the mistress of Lord Buckhurst, who surrendered her about 1670 to the king. As mistress of the king she had an establishment, and was made lady of the privy chamber to Queen Catherine. She was merry and openhearted, is said to have been faithful to Charles, mindful of old friends, and a liberal patroness of the poets Dryden, Lee, Otway, and Butler. From her are sprung the dukes of St. Albans. She died, according to some accounts, in 1687, according to others in 1691.

GYMNA'SIUM (jim-), the name given by the Greeks to the public building where the young men, quite without clothes (hence the name, from gymnos, naked), exercised themselves in leaping, running, throwing the discus and spear, wrestling, and pugilism. Its objects, however, were extended also to the exercise of the mind; for here philosophers, rhetoricians, and teachers of other branches of knowledge delivered their lectures. Gymnasia were at first only open level places, surrounded by a wall, and partitioned off for the different games. Latterly they were composed of a number of connected buildings, spacious enough to admit many thousands. See Gymnastics.

GYMNASIUM, a term applied in Germany to a class of schools corresponding pretty nearly to the American small college.

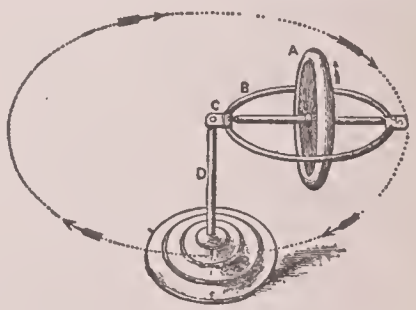
GYMNASTICS, (for derivation, see Gymnasium) is the technical term used to designate any system of exercises specially designed to promote the development of physical, and especially of muscular powers. An excellent gymnastic training is given by baseball, cricket, football, rowing, and similar amusements, but the special value of formal gymnastic exercises is that they are capable of being scientifically arranged so as to secure not only a general development of muscular power, but also an accurate knowledge of the uses of the various muscles, and further that they are capable of being applied to each individual case, so as to meet, allow for, and as far as possible overcome defects in physical organization. For these purposes an elementary course of gymnastics is of great value to all, especially to the sedentary student. In regard to gymnastic exercises two general rules may be laid down, which will form an efficient guide in self-imposed exercises. The first is the universal rule in mechanics that the strength of any machine is the strength of its weakest part; the second is the fundamental law of muscular exercise, that it is exercise within the extreme power of the muscle which develops and improves, while straining weakens and injures, and excessive exercise develops particular muscles abnormally at the expense of the general health. It is quite possible, indeed, to carry physical exercises as a whole too far, and to develop muscular power at the expense of vital strength. Till the age of twelve the ordinary games and pastimes of childhood are generally quite sufficient exercise; after that some very light system of gymnastics may be adopted to aid the development of the system. After the age of thirty-five unusual muscular efforts are apt to leave persistent strains, and moderate exercise becomes the safest means of developing and giving tone to the muscular system.

GYPSIES, (from Egyptians, the name by which they were called in the English statutes), a wandering nation, whose physical characteristics, language, and customs differ much from those of European nations. They call themselves Rommany, from rom (man). This race is slowly melting away. Its present total number hardly reaches 500,000; of whom there are about 120,000 in European Turkey; 140,000 in Hungary; 60,000 in Transylvania; 40,000 in Spain; 40,000 spread over Germany, France, and Italy; 18,000 in Britain, of whom, however, only a small number are tent-gypsies, preserving the language and traditions of their race; and the remainder scattered over other countries. The gypsies are now considered to have come from India, the main body of their language, though mixed with a great number of borrowed words, having a close affinity with some of the Indian languages. Gypsies are remarkable for the yellow brown, or rather olive color, of their skin; the jet-black of their hair and eyes, the extreme whiteness of their teeth, and generally for the symmetry of their limbs. The typical gypsies rarely settle permanently anywhere, but live in tents, wandering about working in wood and iron, making domestic utensils, telling fortunes, practicing tricks, etc. Their talent for music is remarkable, and some of their melodies have become the much-valued property of other nations, or are incorporated in some of our favorite operas. They have no peculiar religion. Among the Turks they are Mohammedans; and in Spain at least, as well as in Transylvania, they follow the forms of the Christian religion, without, however, caring for instruction, or having any real interest in religion. The marriage ceremony is of the simplest kind. If the husband becomes tired of his wife, he will turn her off without ceremony. There is no idea of education among them. The children grow up in idleness and the habits of stealing and cheating.

GYPSUM (jip'sum), a monoclinic mineral, chemically a hydrated calcic sulphate. It is found in a compact state as alabaster, or crystallized as selenite, or in the form of a soft chalky stone, which in a very moderate heat gives out its water of crystallization, and becomes a very fine white powder, extensively used under the name of plaster of Paris (which see).

GYPSY-WORT, a labiate plant found in Britain in ditches and on river banks. It yields a dye said to be used by the gypsies to render their skin darker.

GYROSCOPE, an apparatus, consisting of a rotating disc mounted by very accurately fitted pivots in a ring or rings (forming a sort of gimbals), for illustrating the properties of rotation generally. The fundamental principle of



Gyroscope.

the whole is the resistance which a disc in rapid motion presents to any change of direction in the axis of rotation. Some curious phenomena may be exhibited by it difficult to explain without resorting to mathematical formulæ. The figure shows a simple gyroscope. If the disc A which revolves on an axis within the ring B is set very rapidly in motion by the unwinding of a string round the axis, and if the part C is then rested on a pivot at the top of the upright support D, the apparatus instead of falling will go slowly round in the direction shown by the arrows.

H

H, the eighth letter of the English alphabet, often called the aspirate, as being a mere aspiration or breathing, though not the only aspirated letter in English. The sound that distinctly belongs to it is that which it has at the beginning of a syllable before a vowel, as in hard, heavy. It is very commonly joined to other consonants to represent sounds for which there are no special letters in the alphabet, as in the digraphs ch, sh, th (child, ship, thin, this),

or in other consonantal combinations of various origins and values, as in the words enough (gh = f), plough (gh silent), philosophy (ph = f), rhetoric (h silent), etc. Ch is common in words taken from the Greek, but in this case it generally has the k sound, as in chemistry, chyle, logomachy, etc.

HAARLEM (här'lem), a town of Holland, province N. Holland, 10 miles w. Amsterdam, intersected by the Spaarne, which is joined by canals from Leyden and Amsterdam, and along which a considerable traffic is maintained. Pop. 64,836.

HABEAS CORPUS, in law, a writ addressed to one who has a person in custody, commanding him to produce the body of the person named at a certain place and time.

HABITANTS, or HABITANS, a name applied to the inhabitants of Canada, especially in Quebec province, who are of French extraction, still speak the French language and preserve French costumes. See Canada.

HACKBERRY, the popular name of the North American varieties of the nettle-tree, belonging to the nettle family Urticaceæ.

HACKENSACK, the capital of Bergen co., N. J., on the Hackensack river, and the N. J. and N. Y., the N. Y., Susq. and W., and the W. Shore railways; 8 miles s.e. of Paterson, 13 miles n. of New York. Pop. 11,741.

HACKNEY, a municipal and parliamentary borough of London, 3 miles n.n.e. of St. Paul's. Pop. 253,215.

HACKNEY COACH, a coach let out for hire. Hackney coaches began first to ply under this name in London in 1625, when they were twenty in number. Hackney coachmen are generally put under police regulations, and a tariff of fares imposed upon them. Cabs are now the common kind of hackney coaches.

HADDOCK, a well-known fish of the cod family. It is smaller than the cod, which it much resembles, but it has a dark spot on each side of the body just behind the head. This fish commonly

Haddock.

weighs from 2 to 6 lbs., though sometimes as high as 10 lbs. It breeds in immense numbers in the northern seas in February and March, and constitutes a considerable article of food.

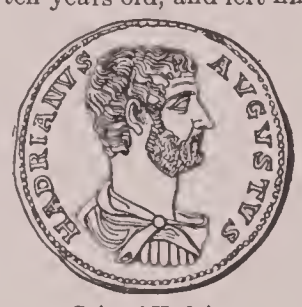
HADES (hā'dēz), originally the Greek name of the lord of the lower or invisible world, afterward called Pluto; but in later times, as in the Greek Scriptures, it is applied to the region itself. With the ancients Hades was the common receptacle of departed spirits, of good as well as bad.

HADJ, the Mohammedan pilgrimage to Mecca, which every Mohammedan ought to perform once in his life, and after which he is entitled to prefix Hadji to his name. The pilgrimage has been made in disguise by Burckhardt in 1814, by Burton in 1853, and by T. F. Keane in 1878, each of whom has published accounts of his journey.

HADLEY, Arthur Twining, American educator, was born at New Haven, Conn., in 1856. In 1879–83 he was tutor in Yale college. He was university lecturer on railroad transportation from 1883 to 1886; commissioner of labor statistics for Connecticut from 1885 to 1887; professor of political science at Yale university, 1886–98; and in 1899 was made president. In 1885 he published Railroad Transportation: Its History and Its Laws, which at once gained him the position of an authority on the subject; it was translated into Russian in 1886, and into French in 1887. He also published: Report on the Labor Question; Report on the System of Weekly Payments; Economics; Education of the American Citizen. President Hadley's writings place him in the first rank among American economists.

HADLEY, John, English astronomer, born toward the end of the 17th century. He is the reputed inventor of the quadrant that goes by his name, though the honor is also claimed for Newton, from whom Hadley got a description of the instrument in 1727, and for Thomas Godfrey of Philadelphia, who produced his instrument about the same time as Hadley in 1731. The Royal Society decided that Godfrey and Hadley were both entitled to the honor of the invention. Hadley also invented the sextant. He died in 1744.

HA'DRIAN, in full, Publius Ælius Hadrianus, the fourteenth in the series of Roman emperors, born at Rome, 24th Jan., 76 A.D. His father, who was cousin to the emperor Trajan, died when he was ten years old, and left him under



Coin of Hadrian.

the charge of his illustrious kinsman. He married Sabina, Trajan's grand-niece, accompanied the emperor on his expeditions, filled the highest offices of state, and, on the death of Trajan, assumed the government as his adopted son (117). Hadrian's policy was a peaceful one, because he saw that the further extension of the empire only weakened it. Although avoiding war as much as he could, he kept the armies in excellent condition, fortified the frontiers in Germany, and, crossing over into Britain, constructed the wall known as Hadrian's Wall (or that of Severus), which protected the Roman province from the barbarous tribes of the north. In 131 he promulgated the Edictum Perpetuum, a fixed code of laws, which forms an important epoch in the development of Roman law. Hadrian died at Baiæ in 138.

HADROSAURUS, a genus of large extinct reptiles, whose remains have been found in the newer cretaceous strata of the United States. It appears to have

Skeleton of hadrosaurus.

resembled the gigantic iguanodon of Europe in its enormous dimensions, herbivorous habits, and anatomical structure.

HÆCKEL (hek'l), Ernst, a German naturalist, born at Potsdam in 1834, studied medicine and science at Berlin, Würzburg, and Vienna; traveled in Norway and Italy, became professor of zoology at Jena in 1865. He is the most prominent exponent of the Darwinian theories in Germany. Among his works we may mention The Radiolariæ (1862), The History of Creation (1868), Anthropology (1874), History of the Evolution of Man (1875), Collected Popular Discourses on the Development Theory (1878–79), Origin and Development of Animal Tissues (1884), etc.

HÆ'MATIN, HEMATINE, the red coloring matter of the blood occurring in solution in the interior of the blood corpuscles or cells. It is the only structure of the body, except hair, which contains iron.

HÆ'MATITE, Red and Brown. See Hematite and Iron.

HÆMOG'LOBIN, HÆMOGLOB'ULIN, the semi-fluid or quite fluid matter of a red color contained in the red corpuscles of the blood. It can be resolved into an albuminous substance called globulin and the coloring matter hæmatin.

HÆMOP'TYSIS, the coughing up of blood, sometimes produced by fulness of the blood-vessels of the lungs or throat, or by the rupture of blood-vessels as a consequence of ulceration. It is distinguished from blood coming from the stomach by the comparative smallness of its quantity, and by its usually florid color. It occurs in heart disease, in pneumonia, and tubercular disease. It is sometimes a case of vicarious menstruation.

HÆMORRHAGE. See Hemorrhage.

HÆMORRHOIDS. See Hemorrhoids.

HAG, the name of fishes, which, with the allied lampreys, constitute the order of Marsipobranchii. They are of worm-like form, and have no eyes or scales, the mouth is formed for suction, is without lips, and furnished with fleshy filaments or barbels. There is a single fang upon the palate and other horny teeth by which the hag eats its way into the interior of other fishes, such as the cod, ling, or haddock.

HAGEN (hä′gĕn), a thriving manufacturing town of Prussia, in Westphalia, at the confluence of the Volme and Ennenè. It has iron and steel works, manufactures of metal goods, textiles, etc. Pop. 50,612.

HAGERSTOWN, a town in Maryland, 6 miles north of the Potomac river. Pop. 14,785.

HAGGARD, Henry Rider, English novelist, born in 1856; held several civil appointments in South Africa, and has made Africa the scene of some of his novels. He became widely known by King Solomon's Mines (1886), and still more by his romantic She (1887), which have been followed by Allan Quatermain, Jess, Maiwa's Revenge, Cleopatra, Eric Bright-eyes, Montezuma's Daughter, Joan Haste, etc. His tales are strong in incident and adventure, but weak in character-drawing.

HAGUE, THE, practically, though not formally, the capital of the Netherlands, in the province of South Holland, 33 miles southwest from Amsterdam, and within 3 miles of the sea. It is the residence of the king and of the foreign

The Hague—The Binnenhof on the Vijver or Pond.

ambassadors, and the seat of the states-general of the Netherlands. It is pleasantly situated, and is distinguished for width and straightness of streets, and general elegance of public buildings. Among the most important structures are the royal palace, the palace of the Prince of Orange, the Binnenhof, a large irregular building, founded in 1249, and containing the hall of assembly of the states-general, and various government offices; also the provincial government-house, a large roomy edifice, the town hall, royal library (200,000 vols.); the Groote Kerk, or Church of St. James, with hexagonal tower and finely vaulted interior; the Mauritshuis, built by Prince John Maurice of Nassau, now converted into a museum containing some of the finest works of the Dutch masters. The Hague arose as a hunting-seat of the Counts of Holland in 1250, and became the political capital of the states in the 16th century. Pop. 205,328.

HAGUE PEACE CONFERENCE, in response to an invitation addressed by the Czar of Russia to the principal states of the civilized world, an international conference of delegates which assembled at The Hague on May 18, 1899, with a view to concerted action for the maintenance of a general peace and the amelioration of the hardships of war, and with a view to the possible reduction of the military and naval armaments of the world. One hundred delegates representing the United States, Mexico, China, Japan, Persia, Siam, and twenty-one European powers were present. No delegates from the Central or South American republics attended. The conference was in session from May 18 to July 29, and was presided over by Baron de Staal of the Russian delegation.

President Roosevelt in his annual message to congress, December 5, 1905, made the following statement of the status of The Hague Peace Conference question:

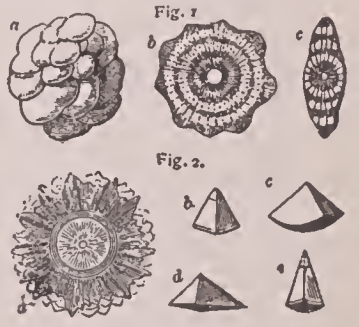
The first conference of nations held at The Hague in 1899, being unable to dispose of all the business before it, recommended the consideration and settlement of a number of important questions by another conference to be called subsequently and at an early date. These questions were the following: (1) The rights and duties of neutrals; (2) the limitations of the armed forces on land and sea, and of military budgets; (3) the use of new types and calibers of military and naval guns; (4) the inviolability of private property at sea in times of war; (5) the bombardment of ports, cities and villages by naval forces. In October, 1904, at the instance of the Interparliamentary Union, which at a conference held in the United States and attended by the lawmakers of 15 different nations, had reiterated the demand for a second conference of nations, I issued invitations to all the powers signatory to The Hague Convention to send delegates to such a conference, and suggested that it be again held at The Hague. In its note of December 16, 1904, the United States government communicated to the representatives of foreign governments its belief that the conference could be best arranged under the provisions of the present Hague treaty.

From all the powers acceptance was received, coupled in some cases with the condition that we should wait until the end of the war then waging between Russia and Japan. The emperor of Russia, immediately after the treaty of peace which so happily terminated this war, in a note presented to the president on September 13, through Ambassador Rosen, took the initiative in recommending that the conference be now called. The United States government in response expressed its cordial acquiescence and stated that it would, as a matter of course, take part in the new conference and endeavor to further its aims. We assume that all civilized governments will support the movement and that the conference is now an assured fact. This government will do everything in its power to secure the success of the conference to the end that substantial progress may be made in the case of international peace, justice, and good will.

HAHNEMANN (hä′nĕ-măn), Samuel Christian Friedrich, the founder of the homœopathic system, born at Meissen in 1755. After practicing in various places, he published in 1810 his Organon der Rationellen Heilkunde, which fully explained his new system of curing any disorder by employing a medicine which produces a similar disorder. (See Homœopathy.) Hahnemann was driven from Saxony by the government prohibiting him from dispensing medicines, but found an asylum ultimately in Paris, where his system was authorized by the government and acquired a certain popularity. He died at Paris in 1843. Among his works notice is due to his Dictionary of Materia Medica, his Essays on Poisoning by Arsenic, and on the Effects of Coffee, and his Treatise on Chronic Affections.

HAIDUCKS, or **HAIDUKS,** a term originally applied to the herdsmen of Hungary, and afterwards to the bands of Magyar foot soldiers, who placed themselves at the service of any potentate who was willing and able to pay them.

HAIL, small masses of ice or frozen rain falling from the clouds in showers



Forms of Hailstones.

Fig. 1. *a*, Hailstone which fell at Bonn in 1822; diameter 1½ inch, weight 300 grains. *b c*, Sections of differently shaped hailstones which fell on the same occasion. Fig. 2. *a*, Section of hailstone with minute pyramids on its surface. *b c d e*, Fragments of do. when burst asunder.

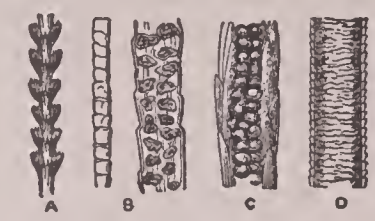
or storms, varying in their form, being either angular, pyramidal, or stellated, as well as in their consistency, being

sometimes as hard as ice and sometimes as soft as snow. At the center there is generally an opaque spongy mass, resembling sleet in its composition, and round this a semi-transparent congealed mass, consisting of a succession of layers or strata, is formed. Properly there are two kinds of hail—the small grains which generally fall in winter and usually before snow; and the large hail which occurs chiefly in spring and summer, and is most severe in very hot climates. The small-grained hail is probably formed by the freezing of rain-drops as they pass in falling through colder air than that from which they started. The large or common hail is probably due to the meeting of two currents of air, of very unequal temperature and electric tension. The usual size of hailstones is about ½ inch in diameter, but they are frequently of much larger dimensions, sometimes even 3 or 4 inches in diameter. In hot climates they are very destructive to crops.

HAINAN, an island of China, belonging to the province of Quang-Tung, between the China Sea and the Gulf of Tonquin, and separated from the mainland by a channel of 15 miles, encumbered with shoals and coral reefs. It is almost oval in shape, and has an area of over 16,000 sq. miles. The fertile lowlands on the northern and western coasts are occupied by immigrant Chinese, to the number of about 1,500,000, who cultivate rice, sugar, tobacco, etc. The fisheries are also productve. The interior, which is mountainous and covered with forests, is inhabited by a distinct race still in a very primitive stage. The capital is Kiang-chow, on the northern coast, a large seaport.

HAINAUT, or **HAINAULT,** province of Belgium, bounded on the south and west by France; area, 1406 sq. miles. About three-fourths of the whole surface is arable, and scarcely a hundredth part is waste. The soil is generally fertile and there are extensive coal-fields, coal, together with flax, linen, hemp, tobacco, and porcelain being the chief articles of export. Manufactures, chiefly cutlery, woolen and linen goods, etc., are carried on to a great extent. The capital is Mons. Pop. 1,029,885.

HAIR, the fine, threadlike, more or less elastic substance, of various form and color, which constitutes the covering of the skin in the class of mammalia. It has the same use as feathers in birds, and scales in fishes and reptiles. No species of mammalia is without hair in an adult state, not even the whales. In quadrupeds it is of the most various conformation, from the finest wool to the quills of a porcupine or the bristles of the hog. The human body is naturally covered with long hair only on a few parts; yet the parts which we should generally describe as destitute of it produce a fine, short, colorless, sometimes hardly perceptible hair. The only places entirely free from it are the palms of the hands and the soles of the feet; but the body of the male often produces hair, like that of the head on the breast, shoulders, arms, etc. Each hair consists of a shaft and a root. The color of the hair is a race character; and the shape of the shaft has likewise been used in this way, transverse sections showing circular, oval, flat, or reniform outlines. The human hair varies according to age, sex, country, and circumstances. At birth an infant generally has light hair. It always grows darker and stiffer with age. The same is the case with the eyelashes and eyebrows. At the age of



Hairs of various animals magnified.
A, Indian bat. B, Mouse. C, Sable. D, Human.

puberty the hair grows in the armpits, etc., of both sexes, and on the chin of the male. The hair of men is stronger and stiffer; that of females longer (even in a state of nature), thicker, and not so liable to be shed. Connected with the hairs are small glands which secrete an oily substance, serving as a lubricant to the skin as well as the hair. These are called sebaceous glands. If the root is destroyed there is no means of reproducing the hair; but if it falls out without the root being destroyed, as is often the case after nervous fevers, the hair grows out again of itself. Each hair, indeed, lasts only a certain time, after which it falls out and is replaced by another as long as the papilla is not weakened. Grayness of hair is caused by a deficient amount of pigment granules in the hair cells. The deficiency arises at the hair bulb where the cells are produced. Any influences that affect the nutrition of the bulb may thus affect the color as well as the growth of the hair. Baldness is caused by atrophy of the papilla, generally due to lessened circulation of the blood in the scalp. For some diseases which have a close connection with the hair, see Plica Polonica, Ringworm, Sycosis. Under ordinary circumstances hair is a very stable substance. It is the last thing which decays, and it often grows after death and lasts for centuries. Hair is not acted on by water, but heated in it under pressure it decomposes, evolves sulphuretted hydrogen, and dissolves; it is also dissolved by alkalies and acids. When burned it emits a disagreeable odor as of burning horn.

Hair for manufacture is furnished chiefly from the horse, the ox, the hog, the goat, especially the Angora or Mohair goat, the camel, and the alpaca. That of the first three is most used for upholstery purposes, the short hair being manufactured into curled hair for stuffing, and the long straight hair manufactured into hair-cloth for seating. The long hair is also reserved for the manufacture of fishing-lines, brushes, etc. White hair is of the most value, being most adapted for dyeing and for the manufacture of fancy articles. The horse-hair used for weaving comes chiefly from Russia, Germany, Belgium, South America, and Australia. Russia chiefly furnishes the bristles, so largely used for brushes. The sable, the minniver, the martin, the badger supply the finer brushes on hair-pencils of painters. The hair of the goat, the camel, and the alpaca is chiefly used in combination with or subordinated to wool and other fibers for spinning and weaving into dress fabrics. Human hair is used chiefly for the manufacture of wigs, curls, beards, chignons, etc. Most of the supply comes from France, Germany, and Italy, where the peasant girls sell their hair to itinerant dealers. In every case, and for any purpose, hair is always best taken from the living subject, dead hair being much inferior.

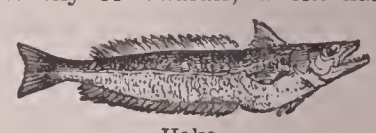
HAIR-DYES, substances for giving hair some particular color desired. The numerous preparations sold for this purpose have generally a basis of lead or nitrate of silver. Bismuth, pyrogallic acid, sulphur, the juice of green walnut shells and other astringent vegetable juices, are also employed.

HAIR-GRASS, a genus of grasses belonging to that division of the order in which the spikelets have two or more florets, and the inflorescence is a loose panicle. It is of little use for cattle, which dislike it, but may serve where covert is wanted for game.

HAIR-POWDER, a preparation of pulverized starch and some perfume, formerly much used to whiten the head, Sometimes the powder was colored. The custom of wearing it was introduced from France into England in the reign of Charles II. To make the powder hold, the hair was usually greased with pomade. It is now scarcely to be seen except on the heads of footmen in attendance on people of rank or wealth.

HAIR-SPRING, in watches, the fine hair-like spring made of steel, which is attached to the axle of the balance wheel and serves by its resisting power to equalize the vibrations of the escapement wheel.

HAKE, a species of North American fishes belonging to that division of the cod family or Gadidæ, which has the



Hake.

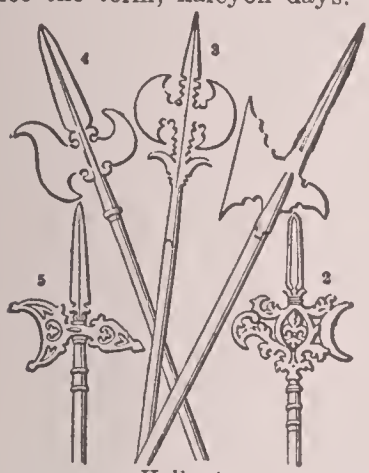
head much flattened, and two dorsal and one long anal fin. The European hake is known in some places as king of the herrings, on which it preys.

HAKODA'TE, a city of Japan, near the south end of the island of Yesso, at the foot of a hill on the shore of a beautiful and spacious bay, which forms one of the best harbors in the world. Hakodate is one of the ports opened to British commerce through Lord Elgin's treaty with the Japanese government in 1858. Pop. 78,040.

HALBERD, or **HALBERT,** an offensive weapon consisting of a pole or shaft about 6 feet long, having its head armed with a steel point edged on both sides. Near the head was a cross piece of steel somewhat in the form of an axe, with a spike or hook at the back. It was much used in the English army in the 16th century, and gave its name to troops called halberdiers, to whom was confided the defense of the colors, and other special

duties. It is now used only on ceremonial occasions.

HAL'CYON, an old or poetical name of the kingfisher. It was fabled to lay its eggs in nests that floated on the sea, about the winter solstice, and to have the power of charming the winds and waves during the period of incubation, so that the weather was then calm; whence the term, halcyon days.



Halberts.

1, Halbert (time of Henry VIII.) 2, Do. with fleur-de-lis (Henry VII.) 3, Double-axed halbert (Charles I.) 4, Halbert (Charles II.) 5, Do. (William III.)

HALE, Edward Everett, American author and clergyman, was born in 1823. He was a Unitarian pastor at Worcester from 1846 to 1850. He contributed voluminously to magazines and newspapers, and edited several of them. He also took great interest in history, and edited Lingard's England, wrote a Chautauquan History of the United States; a Life of Washington, and other works. He is best known for his short story, the famous and effective Man Without a Country. But his most influential book is his Ten Times One is Ten (1870), which led to the formation of many charitable organizations. His Memories of a Hundred Years appeared in 1902.

HALE, Eugene, American legislator, was born in Maine in 1836. He was elected to the forty-first congress in 1868 and was four times re-elected. He declined the post-office folio in Grant's second cabinet and the post of secretary of the navy offered to him by President Hayes. He was elected to the senate in 1881 and has served continuously until the present time, his term ending in 1911.

HALE, John P., a statesman and Free-soil candidate for the presidency, was born in New Hampshire in 1806. Elected to congress in 1842, he became prominent in his opposition to slavery. In 1846 he was chosen United States senator. In 1847 he was nominated for the presidency by the national liberty party, and in 1852 by the free-soil party. His speeches were replete with humor and pathos. His sixteen years in the senate were devoted to the agitation of the slavery question. He was appointed by President Lincoln minister to Spain, where he served four years. He died in 1873.

HALE, Nathan, soldier and hero, was born in Coventry, Conn., in 1755. He enlisted as a volunteer in the revolutionary war, and became lieutenant in Colonel Webb's regiment. On Washington's call for a volunteer to enter the British line and procure intelligence, he responded. Disguised as a schoolmaster, he visited all the enemy's camps in New York and Long Island. He obtained the information required and was about to return when he was arrested as a spy, tried, and condemned to be hanged. The execution took place in New York City. His last words were: "I only regret that I have but one life to lose for my country." He died in 1776.

HALEVY (ȧ-lā-vē), Jacques François Fromental Elie, a French musical composer, born of Jewish parentage at Paris, 1799. The first of his pieces performed was a little comic opera, L'Artisan, given at the Thèâtre Feydau in Paris, in 1827. His chefd'œuvre, La Juive, appeared in 1835, and rapidly obtained a European celebrity. Among his other works are L'Eclaire, Guido et Ginevra, La Reine de Chypre, Le Val d'Andorre, La Fée aux Roses. He died at Nice in 1862.

HALF-BLOOD, in law, relationship by being born of the same father, but not of the same mother (consanguinean relationship); or born of the same mother, but not of the same father (uterine relationship). In the succession to real or landed property in England, the half-blood relations by the fathers' side succeed after the full-blood relations; and next, the half-blood relations by the mother's side.

HALF-BREEDS, a nickname given in 1881 to members of a faction in the republican party in the state of New York, which favored the administration in the controversy between President Garfield and Senators Platt and Conkling, and opposed the regular republican candidate for the governorship of the state, Folger, thus bringing about the election of the democratic candidate, Grover Cleveland. The name was given in derision, as denoting those who were but half republican, by the members of the opposite faction denominated "stalwarts".

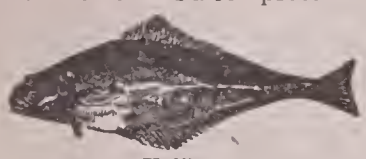
HALFTONE ENGRAVING, a process of engraving plates in relief. These plates have a surface broken into numerous fine square or round dots. These dots are small and separated from each other by wider spaces in the high lights of the picture, are larger and tend to merge into each other in the middle tones, and run together into solid surfaces in the deepest shadows, only broken by very small white points, or even quite devoid of them and in places yielding solid blacks when printed. When viewed at ordinary distances the print from such a plate appears to pass by insensible gradations from white into black, the same as a photograph or photogravure, but closer examination shows the fine texture of dots, usually square, running all over the plate. The method of making these plates is simple in theory but complicated in practice, and involves the use of many of the most recent discoveries of science. The process of negative making is usually the "wet" or collodion method of the early days of photography, as negatives made in this way are more plastic, easier modified, intensified, or reduced. Essential to the process is the presence in the camera of a grating or "screen" made by ruling very fine lines upon a plate of glass. In practice two plates are ruled with these lines diagonally from corner to corner, and are then cemented to each other with the two sets of ruled lines crossing at right angles. The number of lines to the inch is determined by the fineness of engraving desired. The range of screens is from 75 to 200 lines to the inch. This screen is placed in the camera quite close in front of the sensitive plate, so that the image thrown thereon by the lens passes through the openings of the crossed lines. Each of these microscopic openings acts as a separate lens projecting upon the sensitive plate its separate image of the stop opening in the large lens in front. The effect of diffraction causes those openings opposite the most brilliant parts of the image to cast larger as well as more brilliant micro-images or dots upon the plate, while the lesser amount of light passing through the openings opposite the dark parts of the picture produces correspondingly smaller and weaker dots, or even has no perceptible effect. Consequently when the negative is developed it is found to consist of a great number of small dots of sizes graduated in proportion to the light and shade of the picture. The process of reversing the negative to printing upon metal is the same as in zinc etching. The negative is, when dry coated first with a solution of rubber to make it insoluble in the succeeding treatment, and when this is set is again coated with a thick pellicle of plain collodion to give it body and strength. It is then, when dry, cut around the edges and laid in a tray of acidulated water. After a few moments the film loosens from the glass and by cautious handling is peeled from its support and laid face downward upon another plate of glass. It is thus reversed to bring the print upon metal in the proper position to give direct impression when printed. If this were not done, the picture would face the wrong way when completed. In some cases a reversed negative is made in the first instance by using a reflecting prism or a mirror in front of or behind the lens. The metal used for halftone plates is usually copper, but zinc and brass are sometimes employed. It is finely polished, placed upon a whirling machine and coated with a solution of fish glue, albumen, water, and bichromate of ammonia, and dried by gentle heat. It is then locked down upon the negative in a strong printing frame and printed from five to twenty-five minutes by electric light. The development varies with different operators but consists essentially in soaking in running water until the soluble parts of the coating are washed away, leaving a faintly visible image formed of dots of insoluble glue upon the plate. This is burned in over a gas furnace until the metal passes into a silvery hue and the image shows brilliantly in a clear, deep maroon color. The etching is rapidly done by the use of various acid solutions, the one most used being the acid perchloride of iron. When fully etched, the plate is proved and if satisfactory given to the finisher to receive any needed hand engraving or

corrections, after which the edges are beveled upon a beveling machine, it is nailed upon a block of wood, the edges of the black trimmed square, the back shaved off to type height, and it is then ready for the press. The most recent and most rapid of modern engraving methods it is also one requiring the highest skill and technical as well as artistic knowledge to produce satisfactory results.

HALIAETUS (hal-i-a'ē-tus), the genus of birds to which belong the white-tailed sea-eagle of Britain, and the white-headed or bald eagle of America, the chosen symbol of the United States. See Eagle.

HAL'IBURTON, Thomas Chandler, Anglo-American humorous writer, born at Windsor, Nova Scotia, in 1796. He practiced as a barrister in Halifax, wrote a Historical and Statistical Account of Nova Scotia, in 1829, and contributed a series of humorous letters to Halifax newspapers under the pseudonym of "Sam Slick." These were published in book form and were augmented by others, forming The Clockmaker, or Sayings and Doings of Samuel Slick. He died in 1865.

HAL'IBUT, or **HOL'IBUT,** one of the largest of the Pleuronectidæ or flat-fish family, sometimes weighing more than 300 lbs. The fish has a compressed body,



Halibut.

one side resembling the back and another the belly, and both eyes on the same side of the head. It is caught on both sides of the Atlantic, and is much prized for the table.

HALICARNAS'SUS, in ancient geography, the capital of Caria, in Asia Minor, once an important city. Halicarnassus was the native place of Herodotus.

HAL'IFAX, a municipal, parl., and county borough of England, in the county of York (West Riding), on the Hebble, 36 miles w.s.w. York. Halifax commands abundant supplies of coal and water, and an extensive inland navigation connecting it with Hull and Liverpool. It is one of the centers of the woolen and worsted manufactures in Yorkshire, a great variety of goods being produced. There are also iron, chemical, and machine-making works. Pop. 104,933.

HALIFAX, a city, and the capital of Nova Scotia, situated on the slope of a commanding hill, on the western side of Halifax harbor. The harbor is one of the best and most spacious in America. It is easy of access at all seasons of the year. Its length from north to south is about 16 miles, and it terminates in a beautiful sheet of water called Bedford Basin, within which are 10 square miles of good anchorage. The harbor is well fortified, and has an extensive government dockyard. It is the principal naval station of British America, has an extensive foreign and coasting trade, and exports large quantities of fish, lumber, and coals. There are also considerable manufactures embracing iron castings, machinery, nails, soap, leather, tobacco, paper, etc. Pop. 40,832.

HALIFAX, Charles Montague, Earl of, an English poet and statesman, born 1661. He became first lord of the treasury in 1714, and died in 1715. His character was a mixture of meanness and arrogance, but his taste in literature and the arts was good, and he had a great talent for finance.

HALL, Asaph, an American astronomer, was born in 1829 at Goshen, Conn. He studied under Drünnow at Ann Arbor, where he made his first acquaintance with astronomy, and in 1857 went to Cambridge as assistant to Professor Bond. In 1862 he took a civil-service examination and became an aid, and a year afterward professor of mathematics in the United States naval observatory. His greatest fame came from his discovery in 1877 of the two satellites of Mars, which he called Deimos and Phobos. In recognition of this discovery he received a gold medal from the Royal astronomical society, and the award of the Lalande prize from the Paris academy. In 1902 he was president of the American association for the advancement of science.

HALL, Charles Francis, an Arctic explorer, born at Rochester, New Hampshire, United States, in 1821. He began life as a blacksmith, became a journalist in Cincinnati; in 1860 organized an Arctic expedition in search of Franklin, an remained among the Esquimos two years, acquiring their language and habits. In 1864 he undertook a second expedition to the same regions, where he remained till 1869. In 1871, at the instigation of Hall, the United States government fitted out the Polaris for an expedition to the North Pole, and placed Captain Hall in command. The Polaris sailed from New York June 29, 1871, and on 30th Aug. reached lat. 82° 16′ n., and then turned back to winter in a sheltered bay, lat. 81° 38′, where Hall died on Nov. 8. The Polaris was ultimately abandoned by her crew, who reached home only after experiencing many privations and adventures. An account of his first expedition was given by Capt. Hall in his Arctic Researches and Life among the Esquimos.

HALL, Edward, an English chronicler, born in London about 1495. He was a lawyer by profession, and attained the rank of a sergeant, and the office of a judge in the sheriff's court. He had a seat in the House of Commons, and was a zealous Catholic. His death took place in 1547. Hall's Chronicle was published in 1548, and is a curious picture of the manners and customs of the age.

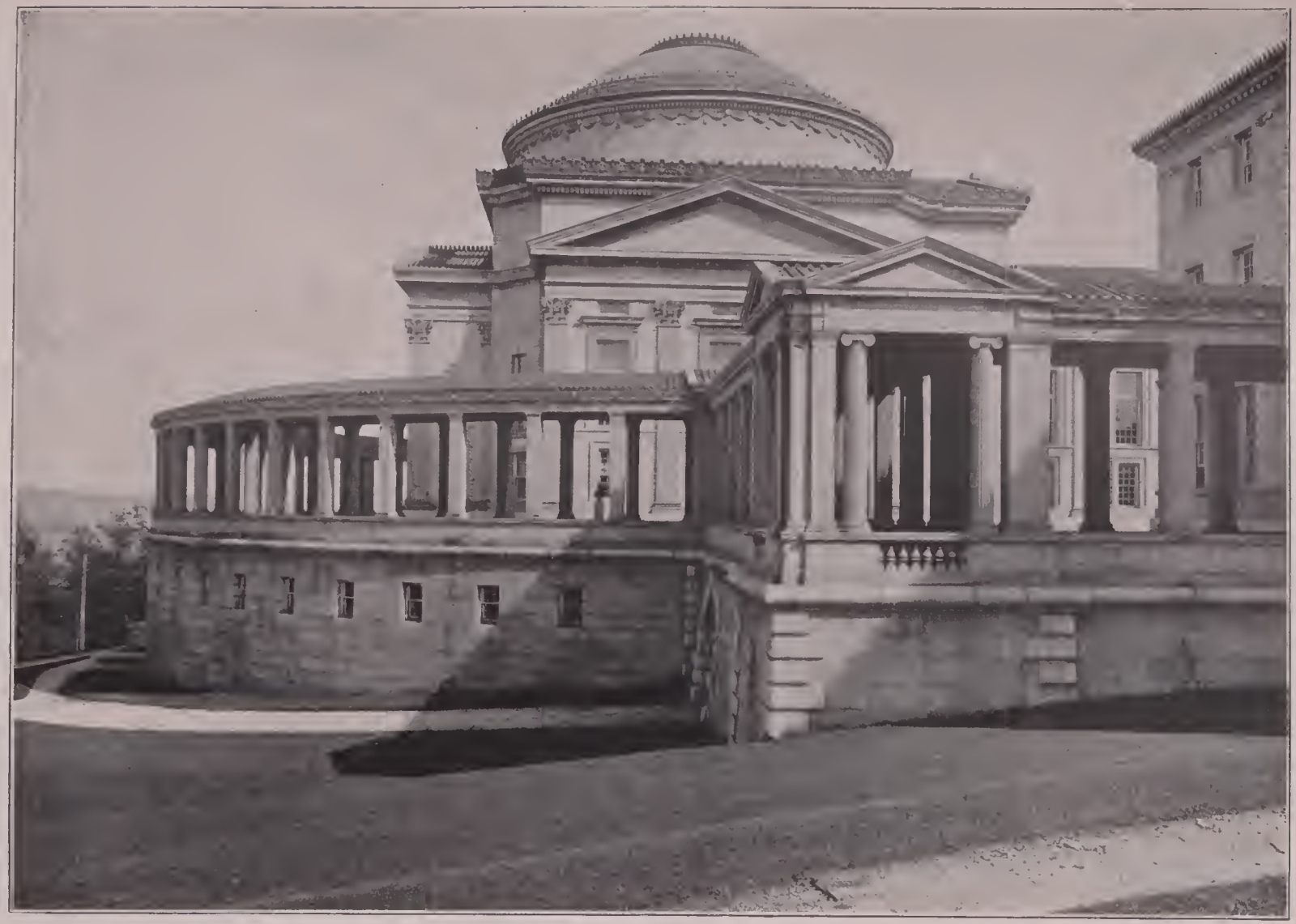
HALLAM, Henry, English historian, a son of the dean of Bristol, born at Windsor in 1777. His contributions to the Edinburgh Review brought him into notice, and his View of the State of Europe, during the Middle Ages, which appeared in 1818, at once established his reputation. His next work, the Constitutional History of England, published in 1827, showed like the first the solid learning, patient research, accuracy and impartiality of statement, which are the characteristics of Mr. Hallam's work. In 1837–39 appeared his last great work, the introduction to the Literature of Europe, He died in 1859.

HALLE (hál'lė), usually called Halle an der Saale (Halle on the Saale), to distinguish it from other places of the same name, an important German town in the Prussian province of Saxony, about 20 miles northwest of Leipzig, on the river Saale. The older streets are narrow and crooked, but the appearance of the town has of late been much improved. Halle is mentioned as early as 806. It was long a powerful member of the Hanseatic League. Pop. 156,611.

HALLECK, Fitz Greene, an American poet, born in 1790. He became a clerk in a New York banking-house, and for years was in the employment of John Jacob Astor. In 1809 poems by him and a friend (J. R. Drake) appeared in the New York Evening Post under the signature of Croaker & Co., and attracted some attention. In 1820 he published Fanny, his longest poem, a satire on the follies and fashions of the day. In 1822 he visited Europe. Among his best poems are Marco Bozzaris, To the Memory of Burns, Alnwick Castle, and Red Jacket. He died in 1867.

HALLECK, Henry Wager, an American general, born at Utica, near New York, in 1815, was educated for the army at West Point, and entered the engineers in 1839. In 1846 he published Elements of Military Art and Science, and he was raised to the rank of captain for his services in the Mexican war. In 1854 he left the army and settled in San Francisco as a lawyer and director of a mining company. On the outbreak of the civil war in 1861 he was created major-general in the United States army. After the victories at Paducah, Fort Henry, Fort Donelson, and the capture of Corinth, he became in 1862 commander-in-chief till superseded by General Grant in 1864. Ultimately he received the command of the South Division at Louisville, where he died in 1872. Among his writings are two works on International Law.

HALLELUIA, or **HALLELUJAH,** or **ALLELUIA** (praise ye the Lord), a Hebrew formula of praise often occurring in the Psalms, and which is retained in the translations of the various Christian churches, probably on account of its full and fine sound, so proper for public religious services. The Great Halleluja is the name given by the Jews to Psalms cxiii.—cxvii., which are sung



THE HALL OF FAME.

The Hall of Fame is a colonnade extending 500 feet in a semicircle and is a part of the New York University. The funds to build it were contributed by Miss Helen Gould. It is to contain 150 tablets to be inscribed with the names of the most notable Americans nominated by a jury of 100 and passed upon by a committee of judges who cannot select anyone who has not been dead ten years. The judges and jurors form, themselves, perhaps the most imposing body of eminent Americans. The first unveiling of tablets took place in 1900 with the following names:

STATESMEN—George Washington, Abraham Lincoln, Daniel Webster, Benjamin Franklin, Thomas Jefferson, Henry Clay, John Adams. JURISTS—John Marshall, James Kent, Joseph Story. SOLDIERS—Ulysses S. Grant, David Glasgow Farragut, Robert E. Lee. SCIENTISTS—Robert Fulton, Samuel F. B. Morse, Eli Whitney, John James Audubon, Asa Gray. TEACHERS—Jonathan Edwards, Horace Mann, Henry Ward Beecher, William Ellery Channing. AUTHORS—Ralph Waldo Emerson, Henry Wadsworth Longfellow, Washington Irvin, Nathaniel Hawthorne. Outside these six classes—George Peabody, Peter Cooper, Gilbert Stuart. A second unveiling took place in 1907 when these additions were made: Emma Willard, Mary Lyon, Maria Mitchell, John Paul Jones, Alexander Hamilton, Louis Agassiz, James Madison, John Quincy Adams, W. T. Lee, John G. Whittier, and James Russell Lowell. Five more tablets will be added in 1911.

on the feasts of the Passover and Tabernacles.

HALLEY, Edmund, an English mathematician and astronomer, born in 1656. In 1682 he discovered the comet which bears his name, and his prediction of its return in 1759 was the first of its kind that proved correct. In 1713 he was made secretary of the Royal society, and astronomer-royal in 1719. He died in 1742.

HALLEY'S COMET, discovered in 1682 by Edmund Halley. Halley's demonstration that this comet was the same with the comet of 1456, 1531, and 1607 first fixed the identity of comets. It performs its revolution in about 75 years. Its last appearance was in 1835.

HALLIWELL-PHILLIPPS, James Orchard, originally J. O. Halliwell, Shakespearean scholar, born 1820, died 1889. His chief Shakespearean publications are a Life of Shakespeare (1848), the Works of Shakespeare in 16 folio volumes, only 150 copies printed, and a great number of pamphlets on Shakespeare. He also published a valuable Dictionary of Archaic and Provincial words.

HALL OF FAME, AMERICAN. "The Hall of Fame for Great Americans" is the name of a building on University Heights in New York city, in which are inscribed on bronze tablets the names of famous American men and women. Nominations for the honor are made by the public and are submitted to a committee of 100 eminent citizens. In the case of men fifty-one votes are required, and in the case of women forty-seven. The first balloting took place in October, 1900. The following have been chosen:

George Washington.
Abraham Lincoln.
Daniel Webster.
Benjamin Franklin.
Ulysses S. Grant.
John Marshall.
Thomas Jefferson.
Ralph W. Emerson.
H. W. Longfellow.
Robert Fulton.
Washington Irving.
Jonathan Edwards.
Samuel F. B. Morse.
David G. Farragut.
Henry Clay.
Nath. Hawthorne.
George Peabody.
Robert E. Lee.
Peter Cooper,
Eli Whitney.
John J. Audubon.
Horace Mann.
Henry W. Beecher.
James Kent.
Joseph Story.
John Adams.
Wm. E. Channing.
Gilbert Stuart.
Asa Gray.

Chosen in 1905:

John Quincy Adams.
Jas. Russell Lowell.
Wm. T. Sherman.
James Madison.
John Quincy Adams.
John G. Whittier.
Alex. Hamilton.
Louis Agassiz.
John Paul Jones.
Mary Lyon.
Emma Willard.
Maria Mitchell.

HALLOW-EVEN, or **HALLOWE'EN,** the evening of the 31st of October, so called as being the eve or vigil of All Hallows, or All Saints, which falls on the 1st of November. It is associated in the popular imagination with the prevalence of supernatural influences, and in Scotland is frequently celebrated by meetings of young people, with the performance of various mystical ceremonies humorously described by Burns in his poem Hallowe'en.

HALLUCINATIONS, according to Esquirol, are morbid conditions of mind in which the patient is conscious of a perception without any impression having been made on the external organs of sense. Hallucinations are to be distinguished from delusions, for in these there are real sensations, though they are erroneously interpreted. Pinel was the first who connected hallucinations with a disturbance of the phenomena of sensation, and the investigation has been pursued further by Esquirol, Maury, Brière de Boismont, and others. All the senses are not equally subject to hallucinations; the most frequent are those of hearing; next, according to many, come those of sight, smell, touch, and taste; and hallucinations of several senses may exist simultaneously in the same individual, and also be complicated with certain delusions. The simplest form of hallucinations of hearing is the tingling of the ears; but the striking of clocks, the sounds of musical instruments and of the human voice are often heard, and in these instances, as in those of the perturbations of the other senses, there must be a diseased sensorium, though there should be no structural derangement of the nerves. Hallucinations are not confined to those whose mental faculties have been alienated, but occasionally assail and torment even the sane. Occasionally hallucinations supervene where the system is healthy, and the individual fully conscious of the unreality of the objects that address his senses, and this disorder is often associated with much ability and wisdom in the conduct of life.

HA'LO, the name given to colored circles of light sometimes seen round the sun or moon, and to other connected luminous appearances. These phenomena are classified as: (1) halos proper consisting of complicated arrangements of arcs and circles of light surrounding the sun or moon, accompanied by others tangent to or intersecting them; (2) coronas, simple rings, generally somewhat colored; (3) aureolas, the name given to the kind of halo surrounding a shadow projected upon a cloud or fog-bank, or to the colored rings observed by aeronauts on the upper surface of clouds. All these appearances are the result of certain modifications which light undergoes by reflection, refraction, dispersion, diffraction, and interference when it falls upon the crystals of ice, the raindrops, or the minute particles that constitute clouds.

HALSTEAD, MURAT, journalist; born in Butler Co., O., 1829. Began newspaper work on a literary weekly; joined staff of Cincinnati Commercial, later consolidated with Gazette as Commercial Gazette, of which he became editor-in-chief. Author: The Story of Cuba; Life of William McKinley; The Story of the Philippines; The War between Russia and Japan, 1905. He died in 1908.

HALYARDS, HALLIARDS, or **HAULYARDS,** the ropes or tackles usually employed to hoist or lower any sail upon its respective yard, gaff, or stay.

HAM, one of the three sons of Noah. He had four sons—Cush, Mizraim, Phut, and Canaan—from the first three of whom sprang the tribes that peopled the African continent, as Canaan became the father of the tribes that principally occupied the territory of Phœnicia and Palestine.

HAM, the inner angle of the joint which unites the thigh and the leg of an animal, but more generally understood to mean the cured and smoked thigh of the ox, sheep, or hog, especially the last. Usually the meat is first well rubbed with salt, and a few days after it is rubbed again with a mixture of salt, saltpeter, and sugar, though sometimes the saltpeter is omitted. After lying for eight or ten days it is ready for drying. The smoking of hams consists in subjecting them to the smoke of a fire, wood being used in preference to coal in the process of smoking. A good ham should have the recently-cut fat hard and white, the lean fine-grained and of a lively red.

HAM'ADRYAD, in Greek mythology, a kind of wood-nymph conceived to inhabit each a particular tree, with which they were born and with which they perished.

View in Hamburg lower harbor.

HAMBURG, one of the free cities of Germany, a member of the Germanic Empire, and the greatest commercial port on the continent of Europe, is situated about 80 miles from the North Sea, on the north branch of the Elbe,

which is navigable for large vessels. The town of Altona adjoins it on the west From the Elbe proceed canals which intersect the eastern and lower part of the city in all directions, and it is also intersected by the Alster, which here forms two fine lakes, the Binnenalster and Aussenalster. The quays and harbors accommodation are very extensive. After the destructive fire of 1842 whole streets were rebuilt in a magnificent and expensive style. Hamburg is not, however, very rich in notable buildings. Among the most important are the church of St. Nicholas, a noble Gothic structure with a lofty tower and spire, built between 1845 and 1874; St. Peter's, another lofty Gothic edifice; St Michael's, the largest of the churches; St. Catharine's, an ancient edifice; St. James', erected in 1354, but surmounted by a modern tower; an elegant Jewish temple; an exchange, a noble edifice, consisting chiefly of a magnificent hall, surrounded by a fine colonnade. There are also the Johanneum institution, containing an ancient college, museums, and the city library, with about 300,000 volumes; several well-endowed hospitals, zoological and botanic gardens; the Kunsthalle, a large collection of pictures and sculpture; theaters, etc. Hamburg is of most importance on account of its great shipping trade and the business of banking, exchange, marine insurance, etc., carried on in connection with that Its manufactures, though large, are less important, including ship-building, tobacco and cigar making, iron-founding, brewing, etc. A great many emigrants embark here. The state of Hamburg embraces a territory of 160 sq. miles, and consists of two divisions, viz:—City of Hamburg, with a population of 705,738; outlying towns and bailiwicks (Cuxhaven, Ritzebüttel, etc.), pop. 62,611. The legislative power belongs in common to the senate and the house of burgesses, but the executive power is vested chiefly in the senate, which is composed of eighteen members, of whom nine must have studied law or finance, and of the other nine seven must belong to the commercial class. The members are elected for life. The house of burgesses consists of 160 members, half of whom are elected every three years by the votes of all tax-paying citizens, while the other half are chosen partly by a much-restricted franchise, and partly deputed by guilds and corporations. In 1815 it joined the Germanic confederation as a free city. In 1888 the city was included in the Zollverein or German customs union.

HAMIL'CAR, the name of several Carthaginian generals, of whom the most celebrated was Hamilcar, surnamed Garca (the lightning), the father of the great Hannibal. While quite a young man he was appointed to the command of the Carthaginian forces in Sicily, in the eighteenth year of the first Punic war, B.C. 247, when the Romans were masters of almost the whole island. For two years he defied all the efforts of the Romans to dislodge him; but the Carthaginian admiral, Hanno, having been totally defeated off the Ægates, B.C. 241, he reluctantly consented to evacuate Sicily. A revolt of the returned troops, joined by the native Africans, was successfully repressed by Hamilcar. He then entered on a series of campaigns in Spain, where he founded a new empire for Carthage. Here he passed nine years, and had brought the whole southern and eastern part of the country under Carthaginian rule when he was slain in battle against the Vettones, B.C. 229. His great design of making Spain a point of attack against Rome was ably carried out by his son Hannibal.

HAMILTON, a thriving town of Canada, in the province of Ontario, county of Wentworth, on the south side of Burlington Bay, Lake Ontario, the principal part being built about 1 mile from the bay. It is the seat of an active and increasing trade, and has manufactures of paper, soap, iron goods, glass, carriages, etc. Pop. 52,634.

HAMILTON, a town in Ohio, county seat of Butler county, on the Miami river, 25 miles n. of Cincinnati. It is a prosperous manufacturing place, has woolen and cotton factories, paper and saw mills, and iron-foundries. Pop. 28,564.

HAMILTON, Alexander, a distinguished American officer and legislator during the contest for independence, was born in 1757 in the island of Nevis, West Indies. At the age of sixteen he be-

came a student of Columbia College, New York. On the outbreak of the war he received (1776) a commission as captain of artillery, and soon attracted the attention of Washington, who appointed him his aide-de-camp and employed him in the most delicate and difficult affairs. In 1781 he left the service, studied law, became a delegate from the state of New York in 1782, and in 1787 was one of the delegates who revised the articles of confederation. He was a strong supporter of the federal party, and by the letters which he wrote to the Daily Advertiser of New York, afterward published under the title of The Federalist, contributed greatly to the success of the party. On the organization of the federal government in 1789, with Washington at its head, Hamilton was appointed secretary of the treasury. This office he held till 1795, when he resigned and retired into private life. In 1798 he was appointed second in command of the provisional army raised under the apprehension of a French invasion, and on the death of Washington, in 1799, he became commander-in-chief. In 1804 he became involved in a political dispute with Mr. Aaron Burr, then candidate for the governorship of New York, accepted a challenge from that gentleman man, and was shot by him July 11, 1804.

HAMILTON, Family of, a family long connected with Scotland, though probably of English origin, the name being evidently territorial. The first person of the name in Scotland of whom we have information was Walter Fitz-Gilbert of Hamilton, who, in 1296, swore fealty to Edward I. of England for lands in Lanarkshire, and held Bothwell Castle for the English at the time of the battle of Bannockburn. For his early surrender of this fortress King Robert Bruce gave him important grants of land. He continued faithful to King David Bruce, and had a command at Halidon Hill under the Stewart of Scotland. In 1445 the family was ennobled in the person of Sir James Hamilton of Cadyow, who was created Lord Hamilton of Cadyow.

HAMILTON, GAIL. See Dodge, Mary Abigail.

HAMILTON, Sir William, a metaphysician, the most acute logician and most learned philosopher of the Scottish school, was born in 1788 at Glasgow, where his father and grandfather held in succession the chairs of anatomy and botany. In 1846 he published an annotated edition of the works of Thomas Reid, and in 1854 the first volume of a similar edition of the works of Dugald Stewart. He died suddenly at Edinburgh in 1856. His lectures on logic and metaphysics were collected and edited by Dean Mansel and Professor Veitch.

HAMITES (descendants of Ham), the name given to a number of races in North Africa, who are regarded as of kindred origin and speak allied tongues. They include the ancient Egyptians and their modern descendants, the Copets, the Berbers, Tuaregs, Kabyles, the Gallas, Falashas, Somali, Dankali, etc.

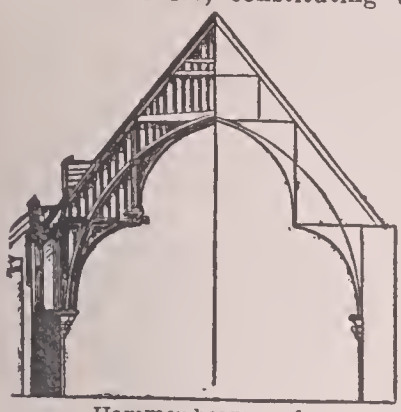
HAMLET, Prince of Denmark, the hero of Shakespeare's famous tragedy. The story is founded on an old tradition, related, among others, by Saxo-Grammaticus, of a Danish prince, Hamlet, who lived about 500 B.C., but essentially altered in details and conclusion.

HAMLIN, Hannibal, American statesman, was born in Maine in 1809. He served in, and was speaker of the lower house of the Maine legislature, and in 1843 was elected to congress. From 1848 to 1857 he was United States senator, for a short time governor of Maine (1857), and again senator. He was elected vice-president of the United States on the ticket with Lincoln in 1860; in 1865 became collector of customs at Boston, and 1869–81 served again in the senate. Later he became minister to Spain. He died in 1891.

HAMMER, a well-known tool used by mechanics, of which there are various sorts, but they all consist of an iron or steel head fixed crosswise to a handle of wood. See Steam-hammer.

HAMMER-BEAM, a short beam attached to the foot of a principal rafter in a roof, in the place of the tie-beam. Hammer-beams are used in pairs, and project from the wall, extending less than half-way across the apartments.

The hammer-beam is generally supported by a rib rising up from a corbel below; and in its turn forms the support of another rib, constituting with



Hammer-beam roof.

that springing from the opposite hammer-beam an arch.

HAMMER-CLOTH, a cloth sometimes used to cover the box-seat of a private carriage. It usually bears the coat of arms of the owner of the carriage.

HAMMERSMITH, a municipal and parliamentary borough of London, about 6 miles w.s.w. of the general post-office. The Thames is here crossed by a fine suspension bridge. Pop. 112,245.

HAMMOCK, a rectangular piece of cloth or netting about 6 feet long and 4 feet wide, gathered together at the two ends and slung horizontally, forming a sort of bed or place in which one may recline for pleasure. Hammocks are in common use on board ships of war. The word is said to be of Caribbean origin, and the Caribs certainly make use of similar hanging beds.

HAMMOND, a city in Lake co., Ind., 21 miles south by east of Chicago, Ill. The industries include extensive steel-spring and chemical works, nail-mills, a slaughtering and meat-packing plant, flour-mills, carriage-works, a distillery, starch-works, a glue-factory, brick-yards, etc. Pop. 14,670.

HAMMOND, John Hays, an American mining engineer, born in 1855 at San Francisco. In 1893 he was appointed consulting engineer to various mining companies operated by a London firm in South Africa, and later to the British South Africa company, known as the Chartered company, to the Consolidated Gold Fields company, and other organizations of promoters acting in that region. While in South Africa he was connected with the Jameson raid, was tried for complicity in the revolt against the South African republic, and was sentenced to death. This sentence was commuted to fifteen years' imprisonment. Hammond was later released by the Boer authorities upon the payment of a fine of $125,000. Afterward he established himself in London, whence he directed mining interests in Mexico and the United States.

HAMPDEN, John, celebrated for his patriotic opposition to taxation by prerogative, was born in London in 1594, being cousin-german by the mother's side to Oliver Cromwell. Although for some years a uniform opposer of the arbitrary practices in church and state, it was not till 1636 that his resistance to Charles' demand for ship-money made him the argument of all tongues. Although the decision in the court of exchequer was given against him by seven voices to five, the victory, as far as regarded public opinion, was his. In the following year (1637) he was one of those who meditated emigration to America, which they were prevented from carrying out by an order in council detaining them. Henceforward he took a prominent part in the great contest between the crown and the parliament, and was one of the five members whom the king, in 1642, so imprudently attempted, in person, to seize in the House of Commons. When the appeal was made to the sword, Hampden accepted the command of a regiment in the parliamentary army under the Earl of Essex, and was fatally wounded on Chalgrove Field, 24th June, 1643.

HAMPSHIRE, Hants, or Southamptonshire, a maritime county, including the Isle of Wight, in the south of England; area, 1,037,764 acres. Pop. 798,756.

HAMPSTEAD, a municipal and parliamentary borough of London. Hampstead Heath crowns the summit of the hill, and is now sprinkled over with handsome villas. Pop. 82,329.

HAMPTON, Wade, American soldier and politician, was born at Columbia, S. C., in 1818. With the secession of his state from the union, he entered enthusiastically into the movement for the establishment of the confederacy, and raised and equipped from his private means the command which, under the name of "Hampton's Legion," did good service for the confederate cause throughout the war. He was engaged in opposing the advance of Sheridan in the Shenandoah Valley in 1864, where he showed such high qualities as a cavalry commander that he was in August of that year commissioned lieutenant-general and placed in command of all Lee's cavalry. Later he commanded the cavalry in Johnson's army, which opposed Sherman's advance from Savannah in 1865. In 1876 he was elected governor, and served until 1878, when he was elected to the United States sen-

John Hancock

ate. There he served by reëlection until 1891. From 1893 to 1897 he was United States commissioner of railroads, to which office he was appointed by President Cleveland. He died in 1902.

HANCOCK, John, American patriot of the revolutionary period, was born at Quincy, Mass., in 1737. In 1774 Hancock was president of the provincial congress, and from 1775 to 1777 of the general congress at Philadelphia, where he was the first to sign the declaration of independence. Returning to Massachusetts, he assisted in framing its constitution, and in 1780 was chosen first governor. He was annually elected to this dignity till 1785, and again from 1787 to 1793, sitting as an ordinary member of the legislature in the interval. He died in 1793.

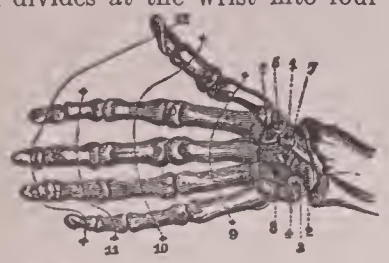
HANCOCK, Winfield Scott, distinguished American soldier, was born in Pennsylvania, in 1824, graduated from West Point in 1844, and served as lieutenant in the Mexican war. He was

Winfield Scott Hancock, 1824-1886.

appointed brigadier-general of volunteers in 1861, fought at Antietam and Fredericksburg, and commanded a corps at Gettysburg, where he was severely wounded. At Spotsylvania, May 12, 1864, he captured 4,000 prisoners and many cannon. After the war he rose to be major-general (1866), and held several department commands, the last being that of the department of the east, with headquarters at New York. In 1880 he was made the democratic nominee for the presidency, but was defeated by General Garfield. He died Feb. 9, 1886.

HAND, the part of the body which terminates the arm, consisting of the palm and fingers, connected with the arm at the wrist; the principal organ of touch and prehension. The human hand is composed of twenty-seven bones, namely eight bones of the carpus or wrist arranged in two rows of four each, the row next the fore-arm containing the scaphoid, the semilunar, the cuneiform, and the pisiform, and that next the metacarpus, the trapezium, the trapezoid, the os magnum, and the unciform. The metacarpus consists of the five bones which form the palm, the first being that of the thumb, the others that of the fingers in succession. Lastly, the fingers proper contain fourteen bones called phalanges, of which the thumb has but two, all the other digits having three each. These bones are jointed so as to admit of a variety of movements, the more peculiar being those by which the hand is flexed backward, forward, and sidcway, and by which the thumb and fingers are moved in different ways. The chief muscles which determine these movements are the flexors, which pass down the fore-

arm, are attached by tendons to the phalanges of the fingers, and serve to flex or bend the fingers; and the extensors for extending the fingers. There are two muscles which flex all the fingers except the thumb. The thumb has a separate long and short flexor. There is a common extensor for the fingers which passes down the back of the fore-arm and divides at the wrist into four tendons, one for each finger, each being attached to all three phalanges. The forefinger and little finger have, in addition, each an extensor of its own, and the thumb has both a short and a long extensor. The tendons of the muscles of the hand are interlaced and bound together by bands and aponeurotic fibers, and from this results a more or less complete unity of action. It is sometimes difficult to make a movement with a single finger without the others taking part in it, as in executing instrumental music, for instance; but practice gives to these movements perfect independence. Of all the movements of the hand the opposition of the thumb to the other fingers, alone or united, especially characterizes the human hand. This action of the thumb results from its length, from the first metacarpal bone not being placed on the same plane as the other four, as is the case in the monkey, and from the action of a muscle —the long flexor of the thumb—peculiar to the human hand. This muscle completes the action of the other motor of the thumb, and permits man to hold a pen, a graver, or a needle; it gives to his hand the dexterity necessary in the execution of the most delicate work. Properly speaking then, the hand, with its highly specialized muscles, belong to man alone. It cannot be considered, as in the ape, as a normal organ of locomotion. It is essentially the organs of touch and prehension. It moulds itself to a body to ascertain its form; it comes to the aid of the eye in completing or rectifying its impressions. The functions of touch devolve principally upon its anterior or palmar face, the nervous papillæ abounding specially at the ends of the fingers. A layer of adipose tissue, very close in texture, protects, without lessening its power or its delicacy, the network of muscles, vessels, and nerves, with which this remarkable organ is equipped.



Skeleton of Human Hand and Wrist.

1. Scaphoid bone. 2, Semilunar bone. 3, Cuneiform bone. 4, Pisiform bone. 5, Os trapezium. 6, Os trapezoides. 7, Os magnum. 8, Unciform bone. 9, Metacarpal bones of thumb and fingers. 10, First row of phalanges of thumb and fingers. 11, Second row of phalanges of fingers. 12, Third row of phalanges of thumb and fingers.

HANDBALL, a variety of "Fives" practiced in the United States chiefly on account of its physical benefits in training for contests of endurance, though it is also one of the sports under the regulations of the Amateur Athletic union. In its simplest form it consists of scoring the ball against a single back wall, with a lined-out space in front; but in its home, Ireland, the court or "alley" on which it is played has also side walls extending the length of the court (60 feet). The floor is 60 x 28 feet, and about the center of it, parallel with the end wall, a line is drawn called the "short line." Sixty feet from the end wall another line is drawn, called the "over line," and every service coming off the wall must fall between these two lines to be in play. The game is started by one player "tossing" out the ball on to the ground and hitting it on the rebound, with his hand, against the end wall. It it falls inside the short line, and the other player fails to return it, it counts an "ace" to the server. Should it be returned and the original server fail to return it, it is a "hand out." Then the service changes, and the game goes on alternately. The game is won by the player who first gets 15 or 20 aces, as agreed.

HANDCUFFS, an instrument formed of two iron rings connected by a short chain or fixed on a hinge on the ends of a very short iron bar, which, being locked over the wrists of a malefactor, prevents his using his hands.

HANDEL (properly Haendel), George Frederick, a great German composer born at Halle on the Saale, February 23, 1685. In 1696 he was sent to Berlin, where he heard the music of Bononcini and Ariosti, then at the head of the

George Frederick Handel.

Berlin Opera House. He returned to Halle, but soon felt to visit Hanover and Hamburg. At Hamburg he played second violin in the orchestra, and brought out in 1704 his first work, an oratorio on the Passion, and his first opera, Almira, followed in February by his Nero, and subsequently by his Florinda and Daphne. In 1706 he went to Italy, visiting Florence, Venice, Naples, and Rome. On his return to Germany he entered the service of the Elector of Hanover, afterward George I. of England, as musical director. He visited England twice, and ultimately having received a pension from Queen Anne, settled down there. Among the operas which he had composed up to this date (1735) are: Dadamisto, Ottone, Giulio Cesare, Flavio, Tamerlano, Scipio, Ricardo I., Orlando, Ariadne, etc. His last opera was performed in 1740. By this time he had begun to devote himself chiefly to music of a serious nature, especially the oratorio. The approval which his first works of this kind (Esther 1731; Deborah, 1732; Athalia, 1733) had met with encouraged him to new efforts; and he produced in succession Israel in Egypt, L'Allegro and Il Penseroso, Saul, and The Messiah. The last-mentioned, which is his chief work, was brought out in 1741, for the benefit of the Foundling hospital. In 1742 the Samson appeared, in 1746 the Judas Maccabæus, in 1748 the Solomon, and in 1752 the Jephthah. In 1752 he became blind, but did not lose his spirits, continuing to perform in public and even to compose. He died at London, 13th April, 1759.

HANDICAPPING, in horse-racing and various other games and sports, a system of equalizing the chances of victory in favor of each of the competitors by allowing certain advantages to an inferior competitor, as, in horse-racing, the making of the best horses carry heavier weights proportionably to the racing qualities, or, in chess-playing, the stronger player giving up one or more of his men at the beginning of the game.

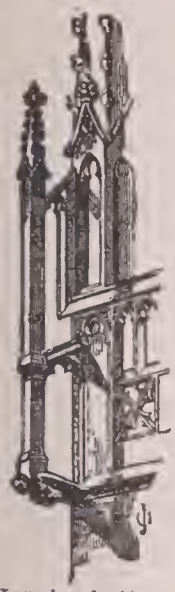
HANDS, Laying on of. This rite, as a token of blessing, or the communication of spiritual gifts, or of something else which could not be literally delivered into the hands of another, has been in use from the earliest times. It occurs in Scripture as a patriarchal usage, appropriate and becoming perhaps rather than strictly religious, but later assumes more of the character of a formal rite, as in the ritual of animal sacrifice among the Jews, when the officer was required to lay his hands on the victim while still alive, except in the case of the paschal lamb. In the early church this rite was used in benediction, absolution, the unction of the sick, and the reconciliation of penitents as well as in ordination and confirmation. The rite is still retained by most western churches in the ceremony of ordination, and in the Roman Catholic, Anglican, and Lutheran churches both in confirmation and ordination.

HANG-CHOW, or **HANG-CHOO,** a Chinese treaty port, capital of the province of Chekiang, on the estuary of the Tsien-tang-kiang. It is one of the handsomest cities of China. with many magnificent temples, monuments, and triumphal arches. It has extensive manufactures in silks, furs, gold and silver ornaments, tapestries, lacquered ware, fans, etc., and a large trade. The larger portion of the inhabitants live without the walls in the beautiful suburbs and in boats on the river. It is also a great center of literary and ecclesiastical life. Pop. estimated at 800,000.

HANGING-BUTTRESS, in arch., a buttress not standing solid on a foundation, but supported on a corbel. It is applied chiefly as a decoration.

HANKOW' ("Mouth of the Han"), a town and river port in China, in the province of Hupeh, at the junction of the Han with the Yang-tse-kiang; Hanyang being on the opposite bank of the Han,

and Wuchang on the other side of the Yang-tse. The port was opened to foreign trade in 1862, and has become the chief emporium for the great tea districts in the central provinces, which formerly sent their produce for export to Canton. Large steamers ascend to the town. In



Hanging-buttress.

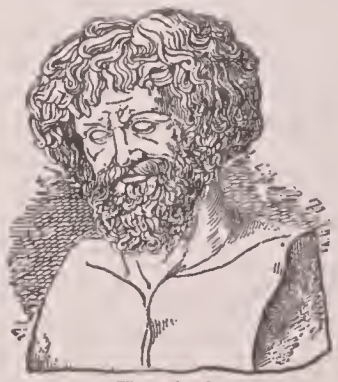
1857 Hankow fell into the hands of the Taiping rebels, and was almost completely demolished by them. Pop. 750,000.

HAN'LEY, a municipal, parl., and county borough of North Staffordshire, England, pleasantly situated on rising ground near the Trent, 18 miles north by west of the county town of Stafford. Pop. of co. bor., 61,524; parl., bor. 100,290.

HAN'NA, Marcus Alonzo, American manufacturer and politician, born in 1837 at Lisbon, Columbiana co., Ohio. In 1896 he suddenly acquired national prominence by the part he took in securing the nomination of William McKinley for the presidency at the republican national convention at Saint Louis. Immediatcly after the convention he became chairman of the republican national committee. In March, 1897, he was appointed United States senator from Ohio. In the senate he did not take a prominent part either as a debater or a legislator; but up to the death of President McKinley he was recognized as one of the most influential advisers of the administration. He died in 1906.

HAN'NIBAL, or **AN'NIBAL,** one of the greatest generals of antiquity, born B.C. 247, was the son of Hamilcar Barca, also a general and leader of the popular party among the Carthaginians. He was but nine years of age when his father made him swear at the altar eternal hatred to the Romans. He grew up in his father's camp in Spain (see Hamilcar), but returned to Carthage when his father fell in battle, in 229 B.C. At the age of twenty-two he returned to the army in Spain, then commanded by his brother-in-law Hasdrubal, and three years after, on the murder of Hasdrubal, received the chief command by acclamation. Hannibal now prepared to carry out his great designs against Rome. His siege and capture of Saguntum, a city in alliance with Rome, led to a declaration of war from the Romans, who made preparations to carry on the war in Spain. But Hannibal, judging that Rome could be overthrown only in Italy, undertook his great march on Rome across the Pyrenees, the Rhône, and the Alps. He set out with 90,000 foot-soldiers, 40 elephants, and 12,000 horsemen. When he reached the northern foot of the Alps he had still 50,000 foot-soldiers, 9000 horse, and 37 elephants. When he arrived at the southern foot, after 15 days of incredible toils, his force had diminished to 20,000 foot-soldiers and 6000 horse. The point at which he crossed is generally believed to have been the Little St. Bernard. On the banks of the Ticino he first encountered a Roman army under Publius Scipio, and defeated it mainly by the superiority of his Numidian cavalry, 218 B.C.

Shortly after another Roman army, under Sempronius, was totally routed on the Trebia. After wintering in Cisalpine Gaul, Hannibal opened next year's campaign (217) by defeating the Roman general Flaminius, whom he enticed into an ambush at Lake Thrasymenus. In this battle half the Roman army perished, and the rest were taken prisoners. Hannibal now marched into Apulia, spreading terror wherever he approached. Rome, in consternation, proclaimed Fabius Maximus dictator, who sagaciously resolved to hazard no more open battles, but exhaust the strength of the Carthaginians by delay. But for sometime the wisdom of this policy was not understood by his countrymen, who, dissatisfied with his inactivity, appointed Minutius Felix his colleague. The result was that the latter was drawn into a battle by Hannibal, and would have perished but for the aid of Fabius. After this the Roman generals avoided engagements, and Hannibal at this



Hannibal.

critical period saw his army wasting away in inactivity. Next year (216), however, the rashness of the new consul Terentius Varro gave Hannibal the last of his great victories. The battle was fought at Cannæ, the Romans under L. Æmilius Paulus and Varro numbering more than 80,000 men, the Carthaginians about 50,000, and ended in a total defeat of the Romans, 40,000 or 50,000 of whom were slain and the rest scattered. Instead of marching on Rome, Hannibal now sought quarters in Capua, where luxurious living undermined the discipline and health of his troops. The campaigns of 215, 214, and 213 were comparatively unimportant. While Hannibal was seizing Tarentum (212), Capua was invested by two Roman armies. To relieve Capua Hannibal marched on Rome, and actually appeared before its gates (211), but the diversion remained fruitless, and Capua fell. In 207 a reinforcement tardily sent by the Carthaginians to Hannibal, under command of his brother Hasdrubal, was intercepted by the Romans and destroyed at the Metaurus. Hannibal now retired to Bruttium (the toe of Italy), where he still maintained the contest against overwhelming odds, till, in 203, he was recalled to defend his country, invaded by Scipio. In Africa he was defeated by the Romans at Zama (202 B.C.), and the second Punic war ended, after a bloody contest of eighteen years, in Carthage having to accept the most humiliating conditions of peace. Hannibal now devoted himself as civil magistrate to restoring the resources of Carthage, and was working at reforms of administration and finance when the jealous Romans sent ambassadors to demand his surrender. He fled to the court of Antiochus of Syria, and offered his services for the war then commencing against the Romans. They were accepted, but Hannibal's advice for the conduct of the war was not followed, and he himself as commander of the Syrian fleet failed in an expedition against the Rhodians. In 190 B.C. Antiochus was forced to conclude a disgraceful peace with the Romans, one of the terms of which was that Hannibal should be delivered up. Hannibal, again obliged to flee, took refuge with Prusias, king of Bithynia, and is said to have gained several victories for Prusias against Eumenes, king of Pergamus, an ally of the Romans. But the Roman senate once more sent to demand the surrender of their inveterate enemy, and Hannibal, finding that Prusias could not protect him, took poison rather than fall into the hands of the Romans. He died in B.C. 183.

HANNIBAL, a town in Marion co., Mo., on the right bank of the Mississippi, 150 miles above St. Louis. It has tobacco factories, machine-shops, foundries, pork-packing establishments, saw and flour mills, and an extensive trade in lumber. Pop. 15,267.

HANOI', or **KESH'O,** capital of Tonquin, on the river Song-ka, in a fruitful plain. Gold and silver filagree, lacquered wares, silks, mat and basket weaving are its principal industries. Although the river is navigable only for small vessels to the trade of Hanoi is considerable, chiefly with the southern provinces of China. Pop. variously estimated from 80,000 to 150, 000.

HAN'OVER, formerly a kingdom in the north-west of Germany, now a province of Prussia. The total area is 14,857 sq. miles. For administrative purposes it is divided into six districts—Hanover, Hildesheim, Lüncburg, Stade, Osnabrück, Aurich. The surface in the south is covered by the Hartz mountains, but the rest of the country is a low, monotonous flat, with a gentle slope to the North Sea.

HANOVER, capital of the Prussian province of Hanover, situated in an extensive plain on the Leine, which here

receives the Ihme and becomes navigable. There are fine promenades, and a large wood with beautiful walks, the Eilenriede, lies on the eastern side of the city. Among the principal buildings are the Market Church, the old town-house, the theater, one of the finest in Germany, the royal palace, the museum of art and sciencc, the royal library, containing 175,000 volumes, the central railway station, the Waterloo monument, etc. About a mile to the n.w. is Schloss Herrenhausen, the favorite residences of George I., George II., and George V. Nearer the town is the colossal Gelfenschloss, or palace of the Guelphs, now fitted up as a polytechnic school. Hanover is a manufacturing town of some importance, has cotton-spinning machine-works, iron-foundries, chemical works, tobacco and cigar factories, etc. Hanover is first mentioned in 1163. It joined the Hanseatic league in 1481. It became the residence of the dukes of Brunswick-Lüneburg, and capital of the principality in 1636. Pop. 235,666.

HANSOM-CAB, a two-wheeled hackney-carriage or cabriolet and named after the inventor. It holds two persons besides the driver, who sits on an elevated seat behind the body of the carriage, the reins being brought over the top.

HAR'AKIRI, or **SEP'PUKU,** a mode of inflicting death upon themselves allowed in Japan to criminals of the Samurai or two-sworded class as more honorable than public execution. It consists in cutting open the body so as to disembowel it by means of a wound made with one sword perpendicularly down the front and another with the other sword horizontally. It is (or was) frequently resorted to to save dishonor or exposure.

HARAR, a town of Northeastern Africa, included in the Abyssinian territories, about 150 miles from the coast of the Gulf of Aden, now reached by a railway from the French port of Jibouti. The inhabitants are strict Mohammedans. Pop. estimated at from 35,000 to 40,000.

HARBOR, a general name given to any bay, creek, or inlet of the sea affording accommodation for ships and protection against the wind and sea. The great requisites of a good harbor are accessibility, adequate depth of water, and shelter from violence of wind and water. Harbors are either natural or artificial, the latter being made wholly or partly by the construction of moles or breakwaters. In connection with the more important harbors there are usually docks, in which the water is kept as nearly as possible at the same level, thus giving facility in loading and unloading. See Breakwater and Docks.

HARCOURT, Sir William George Granville Venables Vernon, lawyer and politician, was born in 1827. Was called to the bar in 1854, became queen's counsel in 1866; was returned for Oxford city in 1869 in the liberal interest; distinguished himself by his powers of satire and ridicule in debate; was made solicitor-general in Mr. Gladstone's ministry, Nov. 1873; home secretary in 1880, when he lost his seat for Oxford but was returned for Derby. In Feb., 1886, be became chancellor of the exchequer under Mr. Gladstone, and he held the same office under the same leader and subsequently under Lord Rosebery in 1892-95, when a change of government took place. He died in 1904.

HARDICANUTE, or **HARTHCANUT,** King of England and Denmark, was the only legitimate son of Canute. At the time of his father's death, in 1036, he was in Denmark, where he was immediately recognized as king. His half-brother Harold, however, who happened to be in England at the time, laid claim to the throne of that part of their father's dominions, and succeeded in getting possession of Mercia, Northumbria, and Wessex, but died in 1040, when Hardicanute peacefully succeeded him. He reigned till 1042, leaving the government almost entirely in the hands of his mother and the powerful Earl Godwin, while he gave himself up to feasts and carousals.

HARDINGE (hâr'ding), Henry, Viscount, English commander, was born in 1785. He was gazetted ensign in 1798, and was present at all the great battles and sieges in the Peninsula. He lost his

Viscount Hardinge.

left hand at the battle of Ligny. He became M. P. for Durham in 1820, was made secretary-at-war, secretary for Ireland, and in 1844 succeeded Lord Ellenborough as governor-general of India. Being forced into war by an invasion of Sikhs he took a command under Lord Gough, and after the great battles of Mudki, Ferozeshah, and Sobraon dictated a peace in the Sikh capital of Lahore. In reward of his services he was created Viscount Hardinge. In 1852, on the death of the Duke of Wellington, he succeeded to the post of commander-in-chief. In 1855 he was made a field-marshal, and he died in 1856.

HARD LABOR, a form of criminal punishment that is comparatively modern. It was introduced in England as an alternative to transportation and penal servitude. It is the creation of statute law both in Great Britain and in this country. A court has no right to sentence a convicted criminal to hard labor, in addition to other punishment, unless a statute gives authority therefor. Hard labor is generally authorized by federal as well as state legislation, however, in most cases where the convicted criminal is subject to imprisonment in a state prison or penitentiary. The kind and amount of labor required of the sentenced criminal are regulated by statute or by prison rules.

HARDNESS, the quality of bodies which enables them to resist abrasion of their surfaces. In mineralogy a scale is used in which a set of standard bodies are arranged and numbered, and other bodies are referred to this scale with respect to hardness. The following is the scale given by F. Mohs:—talc. 1, rock-salt 2, calc spar 3, fluor spar 4, apatite 5, felspar 6, quartz or rock-crystal 7, topaz 8, corundum 9, diamond 10. Materials, according to this arrangement, which are scratched by rock-crystal and are not scratched by felspar are said to have a hardness between 6 and 7.

HARDPAN, the hard stratum of earth beneath the layer of surface soil, especially noticeable in alkali soils. Sometimes this is produced in arable lands by the pressing of the plow and the trampling of the team; but it may be prevented or destroyed when formed, by plowing at varying depths.

HARDWARE, the name usually given to the commoner articles made of iron, brass, and copper.

HARDWOODED TREES, are usually trees of slow growth, such as the oak, beach, witch-elm, ash, service-tree, walnut, chestnut, acacia, etc. They are distinguished from soft-wooded trees such as the willow, poplar, etc., and resinous trees such as the pine, fir, cedar, larch, etc.

HARDY, Thomas, novelist, born in Dorsetshire, England, 1840. He served an apprenticeship as an ecclesiastical architect; published his first novel, Desperate Remedies, in 1872, and has since continued a series of favorite fictions. Among his best-known works are Far from the Madding Crowd, The Hand of Ethelberta, The Trumpet Major, The Woodlanders, The Return of the Native, The Mayor of Casterbridge, Tess of the D'Urbervilles, Jude the Obscure, etc.

HARE, the common name of the rodent quadrupeds with long ears, long hind limbs, a short tail, soft hair, and a divided upper lip; its dental formula is: incisors $\frac{4}{2}$, canines $\frac{0}{0}$, molars $\frac{6}{6} - \frac{6}{6} = 28$; the two fore-feet have five and the hinder four toes. They run by a kind of leaping pace. The females produce litters of three to six about four times a

American varying hare.

year. The young leverets have their eyes open at birth. The common hare is found throughout Europe and some parts of Asia. It is tawny red on the back and white on the belly, and is about 2 feet long. The mountain hare or varying hare confined to Northern Europe and the mountainous regions of the south, is smaller than the common hare,

and becomes white in winter. The American hare is not much larger than a rabbit, is found in most parts of North America. In North America there are also the polar hare, a variety of the varying hare, but of superior size and purer color; and the prairie hare, one of the species known as jackass hares or Jack-rabbits, from their size and length of limb. The hare, which has no courage and little cunning, is protected from its enemies mainly by the acuteness of its sight and hearing and its extraordinary swiftness of foot. Its voice is never heard except when seized or wounded when it utters a sharp loud cry, not very unlike that of a child. Its flesh is rather dry, but is much prized for its peculiar flavor.

HAREBELL, the Scotch Bluebell, a plant common on dry and hilly pastures, etc., with a bell-shaped blue (sometimes white) flower. The radical leaves are cordate or reniform, the stem-leaves partly ovate or lanceolate, partly linear. Its slender steam is from 4 to 6 inches high, and bears sometimes a single flower, but more commonly more than one, in a panicle.

HARE-LIP, a malformation consisting in a fissure or vertical division of the upper lip, sometimes extending also to the palate. Children are frequently born with this malformation, and the cleft is occasionally double The name is given from the imagined resemblance which the part has to the upper lip of a hare. The cure of hare-lip is performed by cutting off quite smoothly the opposite edges of the fissure, and then bringing them together and maintaining them in accurate apposition till they have firmly united.

HA'REM, Hareem', is used by Musselmans to signify the women's apartments in a household establishment, forbidden to every man except the husband and near relations. The women of the harem may consist simply of a wife and her attendants, or there may be several wives and an indefinite number of concubines or female slaves, with black eunuchs, etc. The greatest harem is that of the Sultan of Turkey. The women of the imperial harem are all slaves, generally Circassians or Georgians Their life is spent in bathing, dressing, walking in the gardens, witnessing the voluptuous dances performed by their slaves, etc. The women of other Turks enjoy the society of their friends at the baths or in each other's houses, and appear in public accompanied by slaves and eunuchs; but the women of the sultan's harem have none of these privileges. It is of course only the richer Moslems who can maintain harems; the poorer classes have generally but one wife.

HARGREAVES (hár'grēvz), James, English inventor, author of two important improvements in the art of cotton-spinning, was born near Blackburn about 1720, died 1778 In 1760 he invented a machine for carding, and some years after the spinning-jenny, by which he was able to spin with several spindles at once. Suspecting that he employed machinery, his neighbors broke into his dwelling and destroyed his machine; and on the repetition of this kind of persecution Hargreaves removed in 1768 to Nottingham. In 1770 he obtained a patent for his invention, but it was after all declared invalid on the ground that he had sold several of the machines before taking out the patent. For the rest of his life he carried on business as a manufacturer.

HAR'ICOT, a general term for various species of kidney-bean. They constitute a palatable and nutritious article of diet.

HARLAN, John Marshall, American jurist, was born in Kentucky in 1833. He served in the federal army from 1861 to 1863 as colonel in the 10th Kentucky infantry. In 1877 he was appointed an associate justice of the United States supreme court, which position he still holds. He was one of the American arbitrators on the Bering Sea tribunal which met in Paris in 1893.

HARLEQUIN, a character of the Italian comedy introduced on the stage of other countries. On the Italian stage he is a comic character, full of drolleries, tricks and knaveries, and somewhat resembles the English clown. The harlequin of British pantomimes is quite different. He is supposed to be the lover of the columbine, and possesses a wonder-working wand, with which he protects his mistress against the clown and pantaloon, who pursue and endeavor to capture her, until the pursuit is brought to a termination by a good fairy. The harlequin wears a tight dress of bright colors, and glittering with spangles.

HARLEQUIN DUCK, a species of duck, so called on account of its parti-colored plumage of white, gray, and

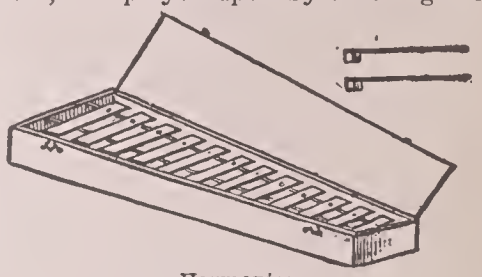
Harlequin duck.

black. It inhabits the Arctic regions, and on rare occasions it visits the British Islands in winter. In length it is about 17 inches.

HARLEY, Robert, Earl of Oxford, English minister, born 1661, died 1724. After the accession of Anne he and his colleague St. John, afterward Lord Bolingbroke, became leaders of the Tories. Harley was chosen leader of the House of Commons in 1702 under Rochester, and in 1704 was appointed chief secretary of state, but resigned in 1708. After the fall of Marlborough Harley became chancellor of the exchequer in 1710, and next year was created Earl of Oxford. He and Bolingbroke secured the Treaty of Utrecht (1713). He made a valuable collection of books and MSS. which latter are preserved in the British Museum, where they form the Bibliotheca Harleiana. Those which have been printed constitute the Harleian Miscellany.

Robert Harley, Earl of Oxford.

HARMON'ICA, Franklin's name for a musical instrument constructed with glasses of different sizes, revolving by means of mechanism worked by the foot, and played upon by touching the



Harmonica.

rim of the glasses with the moistened finger. It constituted the "musical glasses" of Goldsmith's era. The name is now usually applied to an instrument consisting of a series of glass keys played by two small hammers.

HARMON'ICS, the accessory sounds accompanying the predominant and apparently simple tone of any string, pipe, or other sonorous body. No purely simple sound, i.e. no sound whose vibrations are all in the same period, is producible in nature. When a sound is produced by the vibration of an open string, the whole string vibrates as a unity, giving rise to a tone called the fundamental. The string, however, further divides into various sections, which vibrate separately and more rapidly, and produce sounds differing from the fundamental, but bearing certain fixed proportions to it. The first harmonic of the fundamental note of any string is that produced by half the string, and is the octave of the first; the second harmonic is given by the third of the string, and is the fifth or dominant of the fundamental note, and so on, the complete series of harmonics containing all the notes of the musical scale. But, while harmonics enter into the composition of any musical sound from any vibrating body whatsoever, the different structure of different instruments suppresses now some, now others, of the succession of harmonics, and a different body of tone is thus produced, distinguishing a note in one instrument from the same note in another. These differences are called in English quality, in French timbre, in German klangfarbe.

HAR'MONISTS, a religious sect founded at Würtemberg about the year 1788 by two brothers called George and Frederick Rapp. George Rapp died in 1847, but the community still exists.

HARMO'NIUM, a musical instrument of modern invention, producing sounds somewhat resembling those of the organ, resulting from the pressure of wind on a series of vibrating metallic reeds. By the action of bellows, to which the feet communicate a more or less rapid movement, the air is made to impinge against thin tongues of metal (here termed reeds), and to set them vibrating. These metal tongues are fitted into a slit in the top of a small box or sonorous cavity, called a wind-box, and are enabled to vibrate by being fixed only at one end. The discovery that the form of the wind-boxes determines the quality of the sound produced by the vibration of these metallic tongues contributed very much to the development of the harmonium, as it enabled the player to imitate the sound of the oboe, flute, etc. The instrument has a keyboard like that of a piano, and when one of the keys is pressed down a valve is opened, which allows the wind from the bellows to rush through one of the wind-boxes and act on the vibrator. There are several stops, by means of which the performer can direct the stream of wind into the wind-boxes which produce a flute, clarionet, or any other sound. There is also a knee action, which either serves as an expression stop, or brings all the stops of the instrument into play at once, and what is called the percussion action, which consists in the application of a small hammer, which strikes the vibrator as soon as the key is pressed down, and thus aids the action of the wind. The better class of harmoniums have now usually two or more extra rows of vibrators, which, acted upon by separate stops, add so many octaves to the compass.

HARNESS, the various articles which are required to yoke a horse or another animal to any vehicle, or to control and suit them for any kind of work. See Bit, Bridle, Collar, Saddle, etc.

HAROLD (or Harald) **I.,** King of Norway, one of the greatest monarchs of that country, succeeded his father in 863. He brought all the Norwegian jarls under his power, and completely subjected the country, allowing his hair to remain uncut for twenty years until he attained this object (885). He fixed his residence at Trondhjem, and died there in 933.

HAROLD III., King of Norway, the son of Sigurd, a descendant of Harold Haarfager. In his youth he went to Constantinople, joined the Varangian Guard, and took part in the expedition to Italy and Sicily against the African pirates. About 1042 he returned to Norway, after having, on his way through Russia, married the daughter of the Grand-duke Jaroslav. In 1047 he succeeded his nephew, Magnus the Good, as sole king of Norway. In 1066 he joined Tostig, the brother of Harold II. of England, in an invasion of that country, but was defeated and slain at the battle of Stamford Bridge.

HAROLD I., surnamed Harefoot, Danish king of England, succeeded his father Canute in 1035 as king of the provinces north of the Thames, and became king of all England in 1037. After a reign of four years Harold died, in 1040.

HAROLD II., King of England, born about 1022, was the second son of Godwin, earl of Kent. On the death of Edward the Confessor, Jan. 5, 1066, he stepped without opposition into the vacant throne, without attending to the claim of Edgar Atheling, or the asserted bequest of Edward in favor of the Duke of Normandy. He was killed in battle Oct. 14, 1066, and the crown of England passed to William.

HARP, a stringed instrument of great antiquity, found among the Assyrians, Egyptians, Hebrews, Greeks, Irish, Welsh, and other nations. Its variety of form and construction was only equalled by its universality. The modern instrument is well known: its form is nearly

Ancient Harps.
1, 2, Egyptian. 3, Assyrian. 4, Anglo-Saxon.

triangular, and the strings distended from the upper part to one of the sides. It stands erect, and is played with both hands, the strings being struck or pulled with both fingers and thumbs. The instrument in its ancient forms was very defective. Egyptian harps are represented with four, seven, ten, twenty, or more strings, but we have little idea of the scale to which they were tuned. The frames are depicted as being curved in various forms, and the front pillars are wanting. The harps of the Hebrews were probably similar to the Egyptian instruments. It is probable that the various Celtic harps were derived from some oriental pattern. Among the Anglo-Saxons the harp was a favorite instrument. The modern harp was by no means an efficient instrument, until pedals were invented, an invention finally perfected by Sebastian Erard, whose patent was taken out in 1795. In 1810 he patented a double-action harp with seven pedals, each effecting two changes in the pitch of the strings. The harp thus constructed contains forty-three strings tuned according to the diatonic scale, every eighth string being a replicate in another octave of the one counted from.

HARPER, William Rainey, American educator, was born in New Concord, Ohio, in 1856. He graduated at Muskingum college in 1870, and in 1875 received the doctor's degree from Yale. In 1879 he became professor of Hebrew in the Baptist Union theological seminary in Chicago. While here he perfected a system of teaching Hebrew by correspondence. In 1886 he was elected professor of Semitic languages in the graduate faculty of Yale, and in 1889 also professor of biblical literature. In 1891 he was elected to the presidency of the newly founded University of Chicago, which he held until his death in 1906. His published works include: Elements of Hebrew; Hebrew Vocabularies; Hebrew Method and Manual; Elements of Hebrew Syntax. Died, 1906.

HARPER'S FERRY, a village, United States, West Virginia, on the Potomac, at its junction with the Shenandoah, and formerly a United States depôt of military stores. It is famous as the scene of the unsuccessful rising headed by John Brown with a view to destroy slavery (Oct. 16, 1859). The rising was suppressed, and Brown was executed. Harper's Ferry is the seat of Storer college for colored students. Pop. 764.

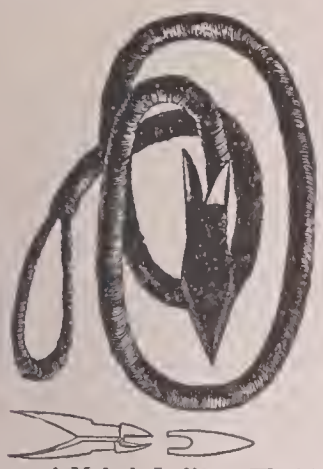
HARPIES, the ancient Greek goddesses of storms. Their parentage, ages, appearance, names, and number are very differently given by the poets. In the Homeric poems they are merely storm-winds. Hesiod represents them as two

Harpy, from an antique gem.

young virgins of great beauty called Aëllo and Ocypete. The later poets and artists vied with each other in depicting them under the most hideous forms covered with filth and polluting everything in contact with them. They are often represented as having female faces.

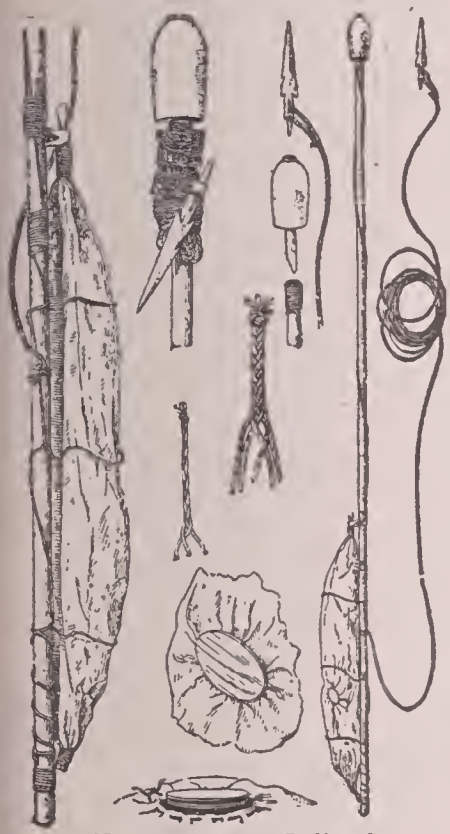
HARPOON, a hunting weapon universally used to catch whales or large fish. The harpoon is generally thrown by hand, but often it is fired from a gun. The modern harpoon is a development from an ancient form such as is now used by savages, and was common not long ago among the North American Indians. Explosive harpoons are sometimes used by modern whalers, and with this weapon the animal is killed. The non-explosive weapon is triangular, arrow-shaped instrument with strong barbs and a shank about three feet long. This is thrown by means of a long rope and the whale thus snared is played until exhausted, when it is easily drawn up to the boat and lanced to death. In recent times a modified form of weapon with only one barb is used. The harpoon outfit

a whaling boat consists of six weapons, in the use of which whalers become



Harpoon of Makah Indians, Washington.

exceedingly expert. The modern explosive harpoon, which has a bomb



Group of North American Indian harpoons.

in its head and kills the animal, is not a harpoon in the real meaning of the word.

HARP'SICHORD, a keyed, stringed instrument formerly in use, in appearance and construction similar to a grand pianoforte. In the front the keys were disposed, the long ones being the naturals, and the short ones the sharps and flats. These keys being pressed by the fingers, their inclosed extremities raised little, upright, oblong slips of wood called jacks, furnished with crowquill plectrums which struck the wires, instead of the hammers of the modern pianoforte.

HARPY-EAGLE, a rapacious bird which inhabits tropical America from Southern Mexico to Southern Brazil. It is an extremely powerful bird, and in total length slightly in excess of the golden eagle. It has, however, a somewhat shorter expanse of wing. Its shoulder muscles possess enormous strength. Its bill is powerful and

Harpy-eagle.

crooked, and its claws are extremely strong and sharp. The harpy-eagle feeds on birds, sloths, fawns, raccoons, etc., as well as on fish, water-snakes, and the eggs of the tortoise.

HARRIS, Joel Chandler, American journalist and author, was born at Eatonton, Ga., in 1848. In 1876 he joined the staff of the Atlanta Constitution and became its editor in 1890. His successful contributions to this paper collected and issued in 1880 under the

title of Uncle Remus, His Songs and His Sayings have become classic. Among his other well known books are Nights with Uncle Remus, Mingo, and other sketches, etc. He died in 1908.

HARRISBURG, the capital of Pennsylvania, 110 miles north of Washington, on the Susquehanna, over which there are three railway bridges besides a bridge for ordinary traffic. It occupies an elevated and commanding site, and has important industries connected with iron and steel and goods manufactured from them, various other industries, and an active trade. Pop. 1909, 80,000.

HARRISON, Benjamin, American revolutionary patriot, one of the signers of the declaration of independence, was born at Berkeley, Va., in 1740. From 1774 to 1777 he was one of Virginia's representatives in the continental congress. From 1782 to 1785 he was governor of the state. In 1788 he was a member of the Virginia convention which ratified the federal constitution. He died in 1791.

HARRISON, Benjamin, the twenty-third president of the United States, was born in North Bend, Ohio, in 1833. He entered the Union army as lieu-

Benjamin Harrison.

tenant, was promoted to colonel and organized the Seventeenth Indiana volunteers. He fought in the Atlanta campaign and at the close of the war held the rank of brigadier-general. In 1876 he was nominated by the republican party for governor of Indiana, but was defeated at the polls. He was elected United States senator in 1881, serving six years. He was nominated for president of the United States in 1888 by the republican national convention at Chicago, and was elected, receiving 233 electoral votes to 168 for Grover Cleveland. Some of the important measures adopted during his presidency were the McKinley tariff bill, the suspension of the Louisiana lottery, the establishment of the reciprocity policy, the extension of the navy, the settlement of troubles in Chile, and the Bering Sea fisheries arbitration. Mr. Harrison was nominated for a second term in 1892 by the republicans but was defeated by Cleveland. He returned to Indianapolis, Ind., and resumed the practice of law. He was one of the counselors for Venezuela in the boundary dispute with Great Britain in 1899 He died March 13, 1901.

HARRISON, Carter Henry, American politician, was born near Lexington, Ky., in 1825, and, was a descendant of the Virginia Harrisons. In 1855 he removed to Chicago. In 1871 he was elected county commissioner of Cook co., and from 1874 to 1878 was a democratic member of congress. In 1879 he was chosen mayor of Chicago, and was reëlected for biennial terms in 1881, 1883, and 1885. In 1884 he was the democratic candidate for governor of Illinois, but was defeated by Governor Oglesby. In 1893 the year of the World's Fair when an able, high-minded admin-

istration was deemed necessary, he was again elected mayor. He was assassinated on October 29th following, one of the closing days of the great exposition.

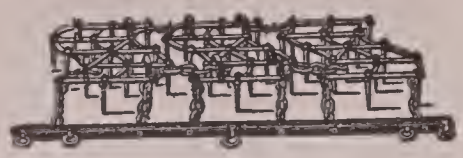
His son, Carter Henry, was born in Chicago in 1860. He was elected mayor of Chicago in 1897, 1899, 1901, and 1903.

HARRISON, William Henry, ninth president of the United States, was born in Charles City co., Va., in 1773. His father, Benjamin Harrison, was one of the signers of the declaration of inde-

pendence. He showed great gallantry at the battle on the Miami (1794). He represented the northwest territory as a delegate in congress in 1799–1800. When Indiana territory was formed (1800), including the present states of Indiana, Illinois, Michigan, and Wisconsin, besides parts of Minnesota and Ohio, he was appointed its governor. He endeavored to avert war with the Indians, but was compelled to quell Tecumseh's outbreak, and beat off a fierce and treacherous attack, ending in an important battle at Tippecanoe (Nov. 7, 1811). In the war of 1812–14 he was appointed to the chief command in the northwest, repulsed the British force under Proctor, and by the victory of Perry on Lake Erie was enabled to pursue the invaders into Canada where, on Oct. 5, 1813, he totally routed them in the battle of the Thames. In 1816 he was elected to congress, and in 1824 became a United States senator. In 1828 he went as minister to Colombia, but was recalled in 1829, and for twelve years was clerk of a county court in Ohio. He received 73 electoral votes for the presidency of the United States in 1836 against Van Buren's 170; but four years later the Whig party having united, they defeated Van Buren, obtaining 234 electoral votes to the latter's 60. Harrison died a month after his inauguration in 1841.

HARRISON, a city in Hudson co., N. J., on the Passaic river and on the Pennsylvania, the Lackawana and the Erie railroads. It is a suburb of New York and is the seat of the State soldier's home. Pop. 12,460.

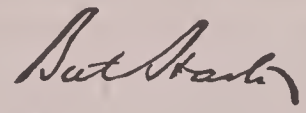
HARROW, an agricultural implement, employed for smoothing land which has been plowed. It consists of a frame of woodwork, or of iron, in which are fixed rows of iron teeth. There are several varieties of this implement, such as the "brake" for breaking down rough land; the "drill harrow" for pul-



Set of iron harrows.

verizing between furrows of green crops, the "grubber" for pulverizing land before the deposition of seed.

HARTE, Francis Bret, American novelist and poet, born at Albany, N. Y., 1839. He went to California in 1854, and figured as a coal-dealer, a teacher, and a type-setter on the Golden Era, in which appeared some of his earliest literary efforts. He next became editor of the Californian, and in 1864 secretary to the United States Mint at San Francisco. In 1868 he became editor of the Overland Monthly, in which appeared, in 1869, the humorous poem of The Heathen Chinee. In 1878 he became



United States consul at Crefeld, whence he was transferred to Glasgow in 1880, and remained there until 1885. Among his best-known works are The Luck of Roaring Camp; The Outcasts of Poker Flat; The Argonauts of '49; Two Men of Sandy Bar; Gabriel Conroy; Mrs. Skagg's Husbands; In the Carquinez Woods; Maruja; Crusade of the Excelsior; A Waif of the Plains; Clarence; etc. He died in 1902.

HARTFORD, the capital of Connecticut, on the Connecticut river, 50 miles above its mouth. It is pleasantly situated, is built with great regularity, and has among its edifices the state-house (built at a cost of 2½ million dollars), city-hall, deaf and dumb and lunatic asylums, Trinity College (Episcopal), R. C. Cathedral, the Wadsworth Athenæum, etc. Both manufactures and trade are of large extent, the former embracing carpets, linen, silk, edge-tools, etc., and it is the seat of the Colt Firearms co. It is a great center of the insurance business. The American asylum for the education and instruction of the deaf

New state capitol, Hartford, Conn.

and dumb at Hartford was started in 1817. Hartford was settled in 1635 by colonists from Massachusetts. Pop. 1909, estimated at 105,000.

HARTINGTON, Right Hon. Spencer Compton Cavendish, Marquis of, born 1833, eldest surviving son of the seventh Duke of Devonshire. He strenuously opposed Mr. Gladstone's Home Rule scheme of 1886, and became the leader of the liberal-unionist party. In 1891 he succeeded to the dukedom. In 1895 he joined the cabinet of Lord Salisbury as president of the council.

HARTLEY, David, an English physician, principally celebrated as a writer on metaphysics and morals, born 1705, died 1757. He became a fellow of Jesus College, Cambridge, and finally practiced medicine at Newark, Bury St. Edmund's, and in London, and ended his days at Bath. In his Observations on Man (1749, two vols.) he formulates his hypothesis of nervous vibration and of the association of ideas.

HARTSHORN, in pharmacy, the horn of the common stag, from which substances deemed of high medicinal value were formerly prepared by distillation, such as spirits of hartshorn, oil of hartshorn, and salt of hartshorn The active ingredient of these was ammonia, which is now obtained from gas-liquor and other sources.

HARUN AL RASHID (hȧ rön' ȧl-rashēd), a celebrated caliph of the Saracens, 786–809. The popular fame of this caliph is evinced by the Arabian Nights' Entertainments, in which Harun, his wife Zobeide, his vizier Giaffer, and his chief eunuch Mesrur are conspicuous characters

HAR'VARD, John, English clergyman in New England, the principal founder of Harvard College, was born in Southwark, London, in 1607. In 1637 he removed to New England and settled at Charlestown, on Massachusetts Bay. His health soon gave way, however, and he died of consumption on September 18, 1638, after a residence in the Colony of little more than a year. By his will he left his library of 260 volumes and a sum of about $2000 to the college at "New Towne," later Cambridge. A year after the young clergyman's death, in commemoration of his benefaction, the

name of Harvard was conferred upon the institution.

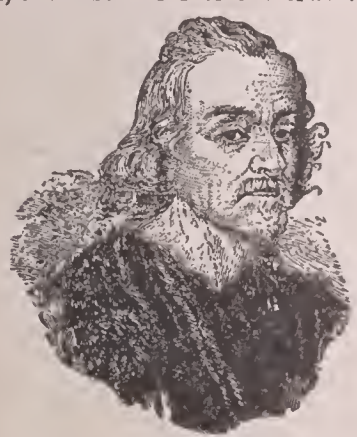
HARVARD UNIVERSITY, the oldest university in the United States, situated in Cambridge, Massachusetts. The principal college buildings number twenty-five, and include several halls, such as University Hall, Harvard Hall, etc. The libraries contain about 450,000 volumes. There are about 80 professors, exclusive of assistants, and the number of students is over 3000. An entrance examination is required in one of two sets of subjects, of which classics predominate in the one, mathematics and science in the other. After the first year's course, which embraces a prescribed series of studies, the student has a large number of different courses to select from in order to qualify for the degree of Bachelor of Arts, the course of study extending to four years. Among the departments connected with the university are: 1. The Law School; 2. The Lawrence Scientific School; 3. The Divinity School; 4. The Medical School; 5. The Dental School; 6 The Bussey Institution of Agriculture; 7. The Veterinary School. We was also mention the Museum of Comparative Zoology (the Agassiz Museum), the Botanical Garden, the Peabody Museum of American Archæology and Ethnology, and the Radcliffe College for women.

HARVEST-MOON, a name which denotes a peculiarity in the apparent motion of the full moon, by which in high latitudes generally it rises about the same time in the harvest season (or about the autumnal equinox in September) for several successive evenings. In southern latitudes this phenomenon occurs in March. It is owing to the fact that the moon is then traveling in that part of her orbit at which it makes the least possible angle with the ecliptic.

HARVEST-MOUSE, the smallest British quadruped, first made known to science by White of Selborne. It builds a globular nest usually suspended among stalks of wheat, etc.

HARVEST SPIDER, a British spider abounding in autumn, and possessing legs of unusual length. When irritated it has the peculiar property of throwing off one or more of its legs.

HARVEY, William, an English physician, the discoverer of the true theory



William Harvey.

of the circulation of the blood, was born at Folkestone 1573, died 1657. He entered Caius College, Cambridge, in 1593, and about 1599 proceeded to Padua, then the most celebrated school of medicine in Europe, and attended lectures on anatomy, surgery, and other branches of medical science. He took the degree of M.D., and returned to England in 1602. He settled in London, was admitted Fellow of the College of Physicians, elected physician of St. Bartholomew's Hospital, and in 1615 was chosen Lumleian lecturer. His views on the circulation of the blood were formally given to the world in his Exercitatio Anatomica de Motu Cordis et Sanguinis in Animalibus (On the Movement of the Heart and Blood in Animals) published at Amsterdam in 1628, in which he claims to have expounded and demonstrated them for upward of nine years. Harvey's theory was attacked by several foreign physicians; but from the commencement his views were widely received. In 1623 he was appointed physician extraordinary to James I. and in 1632 he became physician in ordinary to Charles I. He was present at the battle of Edgehill, and afterward accompanied Charles to Oxford. Here he received the degree of M.D., and was elected Master of Merton College, an office which he lost on the surrender of Oxford to the parliament. He returned to London in 1646, and spent the remainder of his life in retirement. Of Harvey's works, the next in importance to the De Motu is his Exercitationes de Generatione Animalium (On the Generation of Animals; 1651).

HARZ, or **HARTZ** (hârts), the Hercynia Silva of the Romans, the most northerthly mountain chain of Germany, from which an extensive plain stretches to the North Sea and the Baltic. It extends from southeast to northwest, and comprises an extent of about 60 miles in length and nearly 20 in breadth, embracing the towns of Klausthal, Goslar, Blankenburg, Wernigerode, etc. The Brocken, its highest summit, is 3742 feet high. That part of the Harz which includes the Brocken, with the neighboring high summits, is called the Upper Harz, and consists entirely of granite. The southeast portion is called the Lower Harz. The Harz abounds in woods and fine pastures; and is rich in minerals, including silver, iron, lead, copper, zinc, arsenic, manganese, granite, porphyry, slate, marble, alabaster, etc.

HASH'ISH, an intoxicating preparation made in eastern countries from common hemp or rather from the Indian variety of it; also a name for this plant itself or for its tender shoots. The juice of the plant has powerful narcotic properties, and is variously made use of. A resin which the plant gives out is often gathered and kneaded and formed into small balls called churrus, and from this a narcotic is prepared. It has the appearance of a tenacious ointment of a greenish-yellow color, with an acrid savor and a nauseous smell. Hashish produces a kind of intoxication, accompanied with ecstasies and hallucinations. When dried and smoked as tobacco the plant is called bhang; or this name is given to a drink prepared from the leaves and shoots. Ganja or Gunja is the dried shoots of the female plant with the resin on them. Hashish in several forms is employed in medicine.

HASTINGS (hās'tingz), a parl., co., and mun. bor., and market town of England, county of Sussex, one of the Cinque Ports, pleasantly situated on the sea-coast, and including the suburb of St. Leonards-on-Sea. Pop. of parliamentary and municipal borough respectively, in 1901, 62,913 and 65,528.

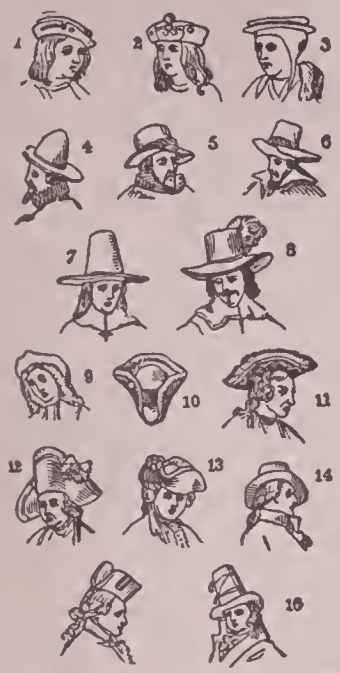
HASTINGS, Warren, first governor-general of India, was born at Daylesford in Worcestershire 1732, and died there 1818. He was grandson of the rector of Daylesford. He was educated at Westminster school, and in 1750 he set out for

Warren Hastings.

Bengal in the capacity of a writer in the service of the East India company. When stationed at Cossimbazar he was taken prisoner by Surajah Dowlah on the capture of the place (1756). Having made his escape, he served as a volunteer under Clive in 1757. He was representative of the company at Moorshedabad from 1758 to 1761. In the latter year he removed to Calcutta, having obtained a seat in the Bengal council, but returned to England in 1764. He left India in 1785, and was impeached by Burke in 1786, being charged with acts of injustice and oppression, with maladministration, receiving of bribes, etc. This celebrated trial, in which Burke, Fox, and Sheridan thundered against him, began in 1788, and terminated in 1795 with his acquittal, but cost him his fortune.

HAT, an outdoor covering for the head of various shapes and materials (as felt, silk, wool, straw), but having a brim as its most distinctive and general feature. Hats are of ancient origin. Among the Grecks, for instance, the petasos was worn, which had a brim, and was similar to the round felt now worn. The shape of the hat has varied extremely in Europe at different periods. The dress hat or silk hat with a smooth nap outside is the most important form of this article at present, though felt hats are perhaps in more general wear. (See Felt). The silk hat was invented at Florence about 1760 The manufacture, however, did not make much progress till 1828. Up to and ever after this time beaver fur was the chief material for hats. A silk hat is composed of a skeleton, to which the silk plush is glued. The skeleton, consisting of three parts, the cylindrical part or body, the crown, and the brim, is usually made of linen, covered with gum-lac, and to the cylindrical part of the crown is gummed

The cylindrical part is made by gumming together the edges of a piece of cloth shaped on a cylinder. The brim is composed of superposed layers of stiffer cloth, and made with a flat projecting surface round its inner edge, which is gummed to the skeleton. For covering the hat a sort of hood of silk plush is made, cut across in an oblique line. This



Forms of hats in 16th, 17th, and 18th centuries. 1, 2, Time of Henry VIII. 3, Time of Mary. 4, Time of Elizabeth. 5, 6, Time of James and Charles I. 7, 8, Time of commonwealth. 9, 10, Time of William III. 11-16, Eighteenth century.

cover is drawn over the skeleton on the block, and fitted exactly to it by the application of a hot iron. The heat of the iron melts the gum-lac, which on cooling cements the covering to the skeleton. The edges of the oblique cut are also coated with gum-lac. The hat is finally shaped on the block or form, and the plush damped and polished, while the hat revolves on a turning-lathe. In the manufacture of straw hats the straw commonly used is that of wheat or barley. The best comes from Italy, and particularly from Tuscany, but straw hats are largely made in England. Palm-leaf hats are imported from China and Manila, and are also machine-made in the United States.

HATCHWAY, a square or oblong opening in the deck of a ship, affording a passage from one deck to another, or into the hold. The after-hatchway is placed near the stern, the fore-hatchway toward the bows, the main-hatchway is placed near the mainmast.

HAUBERK, a kind of coat of mail, comprising the small and the large hauberk, the former consisting of a jacket in scales descending to the hips, with loose sleeves not reaching to the elbow; the latter with a camail or hood, reached to the knee, the sleeves extending a little below the elbow.

HAVAN'A, an important maritime city, capital of Cuba, on the northwest side of the island, with an extensive and excellent natural harbor. Havana is the see of a bishop, and the seat of the governor. The cathedral long contained the ashes of Columbus, which were brought hither from San Domingo in 1796. Among the other buildings are the governor's house, the admiralty, the university, the exchange, the opera-house, etc. The staple manufacture is that of its celebrated cigars. The other manufactures, consisting chiefly of chocolate, straw-hats, and woolen fabrics, are not of much consequence. The trade is extensive, the most important articles

of export being sugar and tobacco, unmanufactured or in the form of cigars and cigarettes; other exports are molasses coffee, wax, honey, rum. The United States have the principal share of the trade, and Spain and England rank next. Several railways start from Havana. The town was founded in 1511, but was only fairly begun in 1519. For a long time Spain derived the chief part of her fleet from the building-yards of Havana. Pop. 235,981.

HAVELOCK (hav'lok), Sir Henry, K. C. B., major-general in the British army, was born at Bishop-Wearmouth, near Sunderland, on 5th April, 1795.

Sir Henry Havelock.

Having entered the army, he served with distinction in the Burmese war (1824—26). On the outbreak of the Indian mutiny he was despatched to Allahabad in order to support Sir H. Lawrence at Lucknow and Sir H. Wheeler at Cawnpore. On his march to Cawnpore he defeated the rebels at Fattihpur, Aong, Pandunadi, and Maharajpur. He died of dysentery at Dilkusha on Nov. 24, 1857. He was raised to the rank of major-general, made a K. C. B., and (before his death was known) created a baronet.

HAV'ERHILL, a town in Massachusetts, on the Merrimac, with extensive manufactures of boots and shoes. Pop. estimated in 1909 at 42,000.

HAV'ERSACK, a bag of strong cloth with a strap fitting over the shoulder, worn by soldiers in marching order, for carrying their provisions.

HAVRE (ä-vr), Le, a seaport of Northern France, dep. Seine-Inférieure, on the north side of the estuary of the Seine, 108 miles northwest of Paris, built of brick or stone in straight, wide streets. The importance of Havre dates from the early part of the 16th century. Pop. 129,014.

HAWAII, or the **SANDWICH ISLANDS,** a cluster of islands, thirteen in number, situated in the North Pacific; total area, 6677 square miles, annexed to the United States in 1898. Five of them are mere islets; all the other eight are inhabited, but only four are of considerable size. They are generally of volcanic origin, and mountainous, with many lofty summits of which Mauna-Kea on Hawaii is 13,953 feet high. Mauna-Loa (13,760 feet), another peak on the same island, is a volcano still active; the last eruption took place in 1881. The surface of the islands is generally rugged, but there are many fertile valleys. The coasts are for the most part precipitous and lofty, and have few good harbors. Hawaii, the largest island, has an area of 4372 square miles, with 46,843 inhabitants. The second largest is Maui, consisting of two peninsulas connected by a low isthmus; area, 488 square miles; pop. 25,416. The chief island is Oahu, area, 647 square miles, pop. 58,504. Honolulu, the capital and chief port of the islands, is situated on Oahu. The remaining large islands are Kauai and Niihau, with an area of 657 square miles, and 20,734 inhabitants. The island of Molokai is a leper colony. The inhabitants of the group belong to the light-colored Oceanic stock, and have been civilized and converted to Christianity. The islands were officially designated as the "Kingdom of the Hawaiian Islands." A new constitution was proclaimed by King Kalakaua I. July 6th, 1887. There are several high-class and numerous elementary schools. All religions are tolerated; protestantism predominating. Railways have been built on Hawaii, Oahu, and Maui. Honolulu, the capital, has become an important entrepôt, and in it almost the whole trade of the islands is centered. The chief exports are sugar, rice, coffee, bananas, tallow, and hides; the imports are chiefly manufactured goods, provisions, grain, and timber. The currency is mostly that of the United States. The islands were discovered by Cook in 1778, who afterward lost his life on Hawaii. Population, 154,001. King Kalakaua died in 1891. Jan. 14, 1893, Queen Liliuokalani was deposed and a provisional government formed. Overtures for annexation were made to the United States. On July 4, 1894, the Hawaiian Republic was proclaimed and the provisional government went out of existence, President Sanford B. Dole becoming president of the new republic. July, 1898, by a resolution of congress and the concurrence of the president, Hawaii was annexed to the United States and the Philadelphia dispatched to take formal possession. United States domestic postal rates are in force.

HAWFINCH, a species of grossbeak, so called from the belief that it subsisted principally on the fruit of the hawthorn.

HAWAII

SCALE OF MILES
0 10 20 30 40 56

Railroads
Steamship Lines
Submarine Telegraph Cables
Size of type indicates relative importance of places

OAHU
WAIALUA
WAIANAE
EWA
HONOLULU
Waialee
Kahuku Pt.
Kahuku
Haleiwa
Laie
Waialua
Hauula
Kahana B.
Kaena Pt.
Wahiawa
Waikane
Kaneohe Harbor
Mokapu Pt.
Lahilahi Pt.
Waianae
Pearl City
Heeia
MOKULUA IS.
Waipahu
Aiea
Kaneohe
Pali
Waimanalo
Ewa
Salt Works
Makapuu Pt.
Barbers Pt.
Pearl R.
Diamond Hd.
Waialae B.
Koko Head
Cable to Midway I.
Cable to San Francisco
KAIWI CHANNEL
Ka Lae o Ka Ilio
Kalaupapa
LEPER SETTLEMENT
Kalawao
Mauna Loa
MOLOKAI
Kalae
Halawa Pt.
Halawa
MOKUO CHANNEL
Laau Pt.
Kaunakakai Ldg.
Pukoo
MOLOKAI
Kamalo
Kai O Kaloh
PAILOLO CHANNEL
Honakohau
Kahakuloa Pt.
Kahakuloa
Waihee
Kahului Har.
Kanapali Ldg.
Honokawai
LAHAINA
Wailuku
Kaena Pt.
Keomuku
Kahalepalaoa
Lanai
LANAI
LAHAINA
Lahaina
Kahului
Puunene
MAUI
WAILUKU
Olowalu
Kihei
MAKAWAO
Kealaikahiki Pt.
Manele B.
Kamaike Pt.
Maalaea Bay
Ulupalakua
Makena Ldg.
MOLOKINI I.
KEALAIKAHIKI CHANNEL
WAILUKU
KAHOOLAWE
HANA
Kauiki Head
Hamoa
Keokea
Kipahulu
Kaupo
ALENUIHAHA CHANNEL
Upolu Pt.
Honoipu Ldg.
Kohala
Akokoa Pt.
Mahukona Har.
Mahukona
Waipio
Kukuihaele
Kamamaka Pt.
Pasthau Ldg.
Honokaa
Paauilo
Kukaiau Ldg.
Laupahoehoe
Kawaihae
Kamuela
Ookala
Kawaihae Har.
Kuku Pt.
Kaaha Pt.
Hapuna B.
KOHALA
Papaaloa
Honokaope B.
Lalamilo
Nohaku Pt.
Kaauau Pt.
Hakalau
Hakalau R.
Keauaiki B.
Honomu
Alia Pt.
Kiholo Bay
Pepeekeo
Onomea B.
Mahewalu Pt.
Mauna Kea 13,805
HILO
Papaikou
Nawili Pt.
Hilo Bay
Keokea Pt.
Hilo
Waiakea Ldg.
Keahole Pt.
Hualalai 8,273
Keaau
Kaiwi Pt.
Olaa
Kailua B.
HUALALAI
HAWAII
Kailua
Holualoa
N. KONA
Kurtistown
Keauhou
Mountain View
Pahoa
C. Kumukahi
Keikawahe Pt.
Kealakekua
PUNA
Kapoho Sta.
Keawekaheka Pt.
Pohaku O Hanalei
Kealakekua B.
Napoopoo
Mauna Loa
Crater of Mokuaweoweo 13,675
Crater of Kilauea 4,040
Volcano House
Honaunau B.
Hookena
Kauhako B
Kauluoa Pt.
KONA
KAU
Kalapana
Keauhou Ldg.
Hoopuloa
Pahala
Okoe Ldg.
Hilea
Punaluu Ldg.
Waiohinu
Honuapo
Naalehu
Kauna Pt.
Kaalualu Har.
KAMUKAHI CHANNEL
Hanalei B.
Haena Pt.
Hanalei
MAQUAEAE Ldg.
Kaihiwai Ldg.
HANALEI
Kilauea
Kuaehu Pt.
Anahola Ldg.
Alapii Pt.
WAIMEA
KAWAIHAU
Kahala Pt.
Kealia
Kaleiumakak Pk.
Mana
Waialeale Pk.
Kapaa
Kapaa Ldg.
KAUAI
LIHUE
Hanamaulu Ldg.
Lihue
Ahukini Ldg.
Nawiliwili Ldg.
Kekaha
Waimea
Waimea B.
Makaweli
KOLOA
Eleele
KaweliKoa Pt.
Koloa
Hanapepe Pt.
Hanapepe B.
Lawai B.
Koloa B.
Makahuene Pt.
LENUA (EGG I.)
Oku Pt.
Pauwai Pt.
Kaeo Mt. 1500'
Kona Pt.
Fuko Pt.
Old Crater
NIIHAU
Cooks Anchorage
Pahau Pt.
Kawahioa Pt.
KAULA (TAHOORA)
KAIEIE WAHO CHANNEL
Kaena Pt.
OAHU
Cable to Midway I.
PACIFIC OCEAN

Hammond's 8 x 11 Map of Hawaii
Copyright, 1905, by C.S. Hammond & Co., N.Y.

Longitude 60° West 59°30′ from Greenwich 59° 58°30′ 56° West 55°30′ from Greenwich 55°

It is one of the largest of the finches. It resembles the chaffinch in color, but is distinguished from it by its enormous

Hawfinch.

beak, larger size, and bill-hook formation of some of its wing-feathers. It feeds on all kinds of berries.

HAWK, a name often applied to all birds of prey except the eagles, vultures, and owls. It thus includes the falcons as well as the hawks proper, the latter being distinguished from the former chiefly by their shorter wings, which do not reach the extremity of the tail, and have the fourth quill longest and the first short; their beaks also are less robust, and want the tooth-like notch of the former.

HAWK-MOTH, one of the sphinx moths, so called from its hovering mo-

Hawk-moth.

tion, which resembles that of a hawk looking for its prey.

HAWLEY, Joseph Roswell, American politician and legislator was born in Stewartsville, N. C., in 1826, and in 1837 removed with his father to Connecticut. In 1861 he recruited the first company of volunteers raised in the state. In 1864 he was made brigadier-general of volunteers and was in 1866 mustered out of service. with the rank of major-general. In the same year he was elected governor of Connecticut, He was elected to fill a vacancy in congress in 1872 and re-elected for the full term of the 43rd congress in 1873. He was again elected to congress in 1878 and at the expiration of his term was elected to the United States senate to which he was re-elected in 1887, 1893, and 1899. In 1884 he was a candidate for the presidential nomination before the republican national convention. He died in 1905.

HAWSE, that part of a vessel's bow where holes called the hawse-holes are cut for the cables going through; also, the hole cut in the vessel's bow.

HAWSER, in ships, a small cable or a large rope, in size between a cable and a tow-line, used in warping, etc.

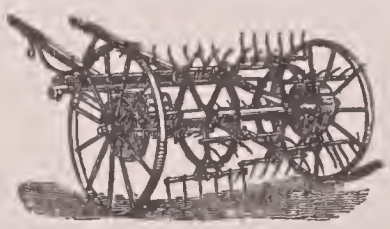
HAWTHORN, or **WHITEHORN,** a small spiny tree, rising sometimes to the height of 20 to 25 feet. The leaves are alternate, obovate, 3 to 5 lobed; the flowers are white, sometimes with a reddish tinge, disposed in corymbs, and possess an agreeable perfume; the fruit is a drupe of a red color, and is edible. The species are about fifty in number, all shrubs or small trees. When young the hawthorn springs up rapidly, and if pruned grows into a thick hedge. When it arrives at the height of a tree, however it makes wood very slowly. The timber is hard and durable, and fit for many purposes of utility. The double-flower kind is one of the most ornamental for shrubberies.

HAWTHORNE, Nathaniel, American author of remarkable originality, born at Salem, Massachusetts, 1804, died 1864. In 1837 appeared his Twicetold Tales, a collection of stories which he had contrib-

Nathaniel Hawthorne.

uted to various American periodicals. In 1838 he was appointed a weigher in the Boston custom-house, a post which he held for a few years. In 1846 he published his Mosses from an Old Manse; in 1850 The Scarlet Letter; in 1851 The House of the Seven Gables; and in 1852 The Life of President Pierce, and the Blithedale Romance. In 1853 he became American consul at Liverpool, a post which he held until 1857. He died at Plymouth, New Hampshire. Other works are his Transformation (1860), Our Old Home (1863), etc.—Julian, son of the above, born 1846, also a novelist. In addition to a biography of his father, he has written the novels of Bressant, Idolatry, Fortune's Fool, etc.

HAY, the stems and leaves of grasses and other plants cut for fodder, dried in the sun, and stored usually in stacks. The time most suitable for mowing grass intended for hay is that in which the saccharine matter is most abundant in the plants, viz., when the grass is in full flow-



Hay-tedder.

er. For the operation of mowing, dry weather, and, if possible, that in which sunshine prevails, is chosen. The making of the grass into hay generally takes three or four days to get it ready for stacking. This period is principally occupied in alternately tedding (i. e. shaking out the grass loosely) and gathering it up into cocks or small heaps, previous to stacking. Care must be taken to avoid haymaking either under a scorching sun or during the prevalence of rain, and the cocks should never be opened in the morning until the disappearance of the dew. In stacking the great object is to preserve the freshness of the herbage, and to induce a slight degree of fermentation. If the weather has been wet a few layers of straw may be inserted at intervals. Salting is also recommended. On large farms the tedding is performed by a tedding or haymaking machine drawn by a horse.

HAY, John, distinguished American statesman and author was born in Salem, Ind., in 1838. He studied law in Springfield, Ill., where he became acquainted with Abraham Lincoln and was taken into his office. He accompanied Lincoln to Washington and served as his private secretary until his assassination. He served as secretary of legation at Paris from 1865 to 1867 and was then chargé d'affaires at Vienna and at Madrid. From 1879 to 1881 he was first assistant secretary of state under President Hayes and in 1897 was appointed ambassador to Great Britain by President McKinley. In 1898 he was appointed secretary of state, and on the death of McKinley was reappointed by President Roosevelt, and reappointed by

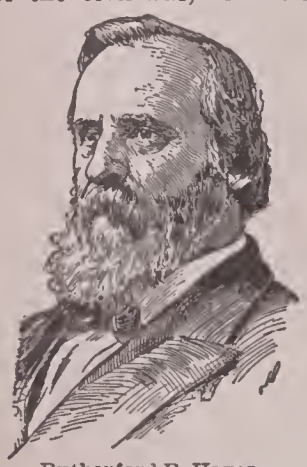
Roosevelt in 1904. Among his diplomatic triumphs was the maintenance of the "open door" policy in China, the settlement of the Samoan dispute by which the United States secured Tutuila with an excellent harbor in the Pacific; the settlement of the Alaskan boundary dispute, the negotiation of recipocity treaties with Argentina, France, Germany, Cuba, and the British West Indies and the negotiation of a treaty with Great Britain relative to the construction of an outer oceanic canal (See Hay Pauncefote Treaty) new treaties with Spain and one with Denmark for the cession of the Danish West Indies. His Pike County Ballads brought him literary disinction. With John G. Hay,

he wrote an authoritative life of Lincoln. The anonymous novel, The Bread Winners, is generally attributed to him. He died in 1905.

HAYDN (hī'dn) Joseph, a celebrated German musical composer, born at Rohrau, on the borders of Hungary and Austria, 1732, died 1809. Haydn's principal merit consists in his opening up a new development of instrumental composition, of which his 125 orchestral symphonies furnish abundant proof. In 1798 he published his oratorio of the Creation, and in 1800 that of the Seasons. He may be said to be the originator of the symphony and of the stringed quartette.

HAYES, Isaac Israel, American Arctic explorer, born 1832, died 1881. He was a member of the expedition of 1853–55 under Dr. Kane, and himself commanded an expedition in 1860–61. He served as an army doctor during the war, and in 1869 he visited Greenland. He wrote The Open Polar Sea, and The Land of Desolation.

HAYES, Rutherford B., nineteenth president of the United States, was born in Delaware, Ohio, in 1822. At the outbreak of the civil war, he was made a



Rutherford B. Hayes.

major of volunteers. His conduct on the field was marked by conspicuous gallantry, and he attained the rank of brevet-major-general. In 1865 he was elected a member of congress, where he won the reputation of a working member. In 1867, 1869, and 1875 he was elected governor of Ohio. In 1876 he was nominated for the presidency. An electoral commission, appointed by congress, was required to decide the result of the election, which declared in favor of Mr. Hayes. His administration was conciliatory toward the South, and earnest in its efforts for the reform of the civil service. After his retirement from the presidency his life was spent in the cause of temperance and prison reform. He was a member of the Peabody education board for the instruction of freedmen. He died in 1893.

HAY-FEVER, or **HAY-ASTHMA,** a complaint caused by the odors of flowering grasses, of a stable, or of certain drugs such as ipecacuanha. The disease varies from the symptons of a severe cold up to those of spasmodic asthma. The patient is tormented with headaches, his eyes are suffused, he sneezes violently, and there is an acrid discharge from the nose, with harassing cough. Removal from the cause of the disease is beneficial, so are the smoking of tobacco, the inhalation of vapor of creosote, etc. Helmholtz has discovered vibriones in the mucus of patients afflicted with hay-fever.

HAYNE, Paul Hamilton, American poet, was born in Charleston, S. C., 1831. He published several volumes of poems which won for him a genuine reputation as a poet. Among his later productions are Legends and Lyrics and The Mountain Lovers. He died in 1886.

HAYNE, Robert Young, American political leader, was born in South Carolina in 1791. In the war of 1812 he was captain of the Third South Carolina regiment. In 1823 he was elected as a states rights democrat to the United States senate. He is best known for his great debate with Daniel Webster covering the question of the relation of the states to the federal government. He was one of the committee of 21 that reported the ordinance of nullification. In 1832 he was elected governor of South Carolina. He died in 1839.

HAY-PAUNCEFOTE TREATY, the treaty negotiated in 1901 by John Hay on the part of the United States, and Lord Pauncefote on the part of Great Britain, which superseded the Clayton-Bulwer treaty and declared the policy which would control the United States in the construction and maintenance of an isthmian canal between the Atlantic and Pacific oceans. The treaty transmitted to the United States senate by President McKinley provided: (1) For the construction of the canal by or under the auspices of the United States government; (2) for its neutralization on the same basis as the Suez canal; and (3) for an invitation to other powers to join in guaranteeing such neutrality. The treaty was ratified by the senate with three amendments, the first of which provided that the restrictions contained in the second article, based on the Suez convention, should not apply to such measures as the United States might find it necessary to take for their own defense and the maintenance of public order; the second explicitly stated that the Clayton-Bulwer treaty was thereby suspended; and the third struck out the provision in regard to the guarantee to be asked of other non-constructing powers. In its amended shape Great Britain refused to ratify the convention, and it expired by limitation on March 5, 1901. A new treaty was transmitted to the senate by President Roosevelt and ratified by that body. The principal differences between the first and final treatics were three in number: (1) No guarantees of the canal's neutrality were to be asked either of Great Britain or any other power; (2) the Clayton-Bulwer treaty was specifically abrogated, although the general principle of neutrality contained therein was retained; (3) certain undefined rights of control were to be allowed to the United States in time of war, the exact nature and extent of which was not specified, but there was no requirement that the canal should be kept 'open and free in time of war as in time of peace, nor was there a prohibition of the erection of fortifications commanding the canal or its adjacent waters.

HAYTI, HAITI, or **SAN DOMINGO,** (originally Española; Latin, Hispaniola), one of the West Indies, after Cuba the largest and one of the most fertile of these islands. It lies southeast from Cuba, and is separated from it by the Windward passage, 50 miles broad. Its length is 400, and breadth 150 miles; area, about 28,000 sq. miles, or nearly as large as Scotland.

Hayti was discovered by Columbus in 1492. It was then inhabited by perhaps 2,000,000 natives, but so ruthlessly did the Spaniards deal with the aborigines that within a century they practically exterminated them, having introduced negro slaves in their place. In 1630 the French settled in the western part of the island, and in 1697 the western portion was ceded to them, while the eastern remained Spanish. It now comprises the Republic of Hayti on the west side of the island, and the Dominican Republic on the east. Port-au-Prince is the capital of Hayti, and the population of the republic is roughly estimated at 960,000, consisting of negroes and mulattoes. San Domingo is the capital of the Dominican Republic, and the population of the latter state is estimated at 500,000, consisting also of negroes and mulattoes, with a considerable admixture of whites. In Hayti French is the prevailing dialect; in the Dominican Republic, Spanish. The area of the former compriscs 10,204 sq. miles; that of the latter, 18,045 sq. miles. The state of society in Hayti is represented as deplorable, cannibalism being said to be common.

HAZ'ARD, a game at dice played for money. The player is called the caster, and his opponent, who bets with him, is called the setter. The former calls a main, i. e. any number from 5 to 9 inclusive. He then throws with two dice, and wins if he "nicks." Five is a nick to 5; 6 and 12 are nicks to 6; 7 and 11 to 7, etc. The caster loses or "throws out" if he throws aces, or deuce ace (called crabs). Hazard is a game involving nice calculations.

HAZEL, a genus of shrubs or small trees indigenous to Europe, North Africa, Asia and North America. The leaves are roundish-cordate, alternate, and shortly petiolate. The European hazel produces the nuts called filberts, and grows best in a tolerably dry soil. It bears male and female flowers, the former composing cylindrical catkins. The hazel-nut oil is little inferior in flavor to that of almonds. Hazel branches form excellent walking-sticks, fishing-rods, etc., and the wood produces good charcoal, often employed by painters. The American hazel very much resembles the European. The roots are used by cabinet-makers for veneering; and in Italy the chips are sometimes put into turbid wine for the purpose of fining it.

HA'ZELINE, an alcoholic liquid distilled from the fresh leaves of the witch hazel, native of the United States. It is exceedingly useful as an application to wounds, staunching the bleeding and promoting healing. It is equally useful for bruises, inflammatory swellings, sprains, and the like. It is applied on a pledget of lint to bleeding piles. In internal bleeding, whether from the lungs, stomach, or bowels, it gives very satis-

1. Lombardy, silver pins. 2. Spain, comb. 3. Catalonia, simple kerchief. 4. Dalmatia, plaited cloth for shading the face. 5. Herzegovina, kerchief trimmed with coins and lawn, 6. Westphalia (Rinteln), cap. 7. Baden (Margraviate), bow of ribbons. 8. Switzerland, miniature hat of flowers. 9. Spree Forest, kerchief. 10. Crossen on the Oder, kerchief in the form of a cap. 11. Switzerland, gala hood. 12. Black Forest, bridal attire. 13. Altenburg, bridal attire. 14. Spanish woman, veil. 15. From the district of Huemling, straw bonnet. 16. Black Forest, cap. 17. Holland, Island of Marken, cap. 18. Tyrol, hat. 19. Montafon, high cap. 20. Transylvania, bridal attire. 21. Black Forest, silk hat. 22. Black Forest, straw hat. 23. Holland, Scheveningen, cap and hat. 24. Valley of the Sarne, fur cap.

HEAD-DRESS OF EUROPEAN WOMEN.

factory results. There are several officinal preparations of the witch-hazel, a fluid extract and a tincture, the dose of the former being 15 to 60 drops, and of the latter 2 to 5. Hazeline is the name ivegn to a clear colorless liquid prepared by certain chemists, but not officinal, of which a tea-spoonful may be given. The American patent medicine, Pond's Extract, is the same as is also Witch Hazel, used for its cooling and soothing effect.

HAZELTON (hā'z'l-tun), a city in Luzerne co., Pa., on the Penn. and the Lehigh Val. Railways; 80 miles n.n.w. of Philadelphia. It has valuable anthracite coal-mining interests, is principally engaged in mining and hatting. Pop. 17,140.

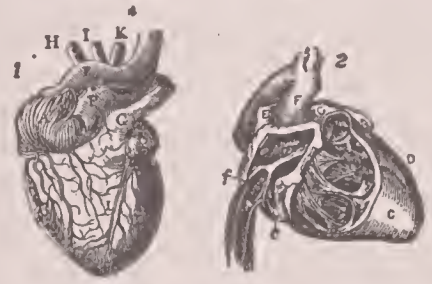
HEAD, the term applied to the anterior part of the body of an animal when marked off by a difference in size, or by a constriction (neck). A gradual increase of complexity in the structure of the head is observable as we ascend from the lowest to the highest forms of life. In the Protozoa, Infusoria, and Cœlenterates nothing that can be regarded as a head is found, and it is not until we ascend to the worms proper, the articulated animals (crustaceans, myriapods, spiders, and insects), the land and fresh-water gasteropods (snails and whelks), and the cuttle-fishes, that a head proper is found. The cuttle-fishes have a remarkable cartilaginous box, which, like a skull, protects their anterior nervous ganglia and gives support to the muscles. The head of the vertebrated animals presents a regular series of increasing complexity from the lancelet upward, and as the anterior nervous mass enlarges, and its ganglia increase in complexity, so do the anterior vertebræ change their character; as the brain becomes specialized, so does the brain-case or skull, attaining its highest development in man. In man, and in the higher vertebrates, the head consists of an upper chamber, lodging the brain, the eyes, and other sense organs, and a lower, lodging the first portion of the alimentary canal. In proportion as the vertebrates become developed, the brain increases in size, and its position advances anteriorly, until, in man, it comes to overhang the face. The head is the seat of intelligence and of consciousness, as it contains the brain and the organs of sense, touch being the only sense not ilmited to it.

HEADACHE, arises from a variety of causes. The principal forms it assumes are: (1) Congestive Headache, arising from over-fulness of blood. It may be cured by purgatives, while reduction of the diet and saline medicines are beneficial. (2) Anæmic Headache, which arises from a deficiency of blood, and occurs in persons badly fed or in weak girls. Good food and iron tonic, with application of cold to the head, are often of service in such cases. (3) Nervous Headache, which often attacks the studious, and which is relieved by nerve tonics. and especially by phosphorus pills. (4) Neuralgic Headache, which is often due to exposure to cold. What is called Hemicrania or Megrim, which is the limitation of the headache to one-half or less of the head, is often treated with bromide of potassium. In cases in which headache arises from disease of the liver, nausea results, and this characterizes bilious headache. Impurity of blood and gouty affections, as well as disease of the kidneys, are frequent sources of headache.

HEALTH, is that condition of the living body in which all the bodily functions are performed easily and perfectly, and unattended with pain. The most perfect state of health is generally connected with a certain condition of the bodily organs, and well marked by certain external signs. See Sanitary Science.

HEARSE. See Herse.

HEART, a hollow muscular organ, the function of which is to maintain the circulation of the blood, the organs of circulation being the heart, the arteries, the veins, and the capillary vessels. The heart in men, quadrupeds, birds, and some reptiles is composed of four cavities, two auricles and two ventricles. It is enveloped in a membrane called the pericardium, and is situated toward the left of the cavity of the chest, between the lungs. With each beat the apex of the heart strikes against the wall of the chest



Human Heart.

Fig. 1, Exterior. A, Right auricle. B, Left auricle. C, Right ventricle. D, Left ventricle. E, Vena cava superior. F, Aorta. G, Pulmonary artery. H, Brachiocephalic trunk. I, Left primitive carotid artery. K, Left subclavian artery. L, Left coronary artery.

Fig. 2, Section, right side. C, D, E, F, G as in Fig. 1. *a*, Cavity of right auricle. *b*, Inferior vena cava. *c*, Coronary valve. *d*, Entrance of the auriculo-ventricular opening. *e*, Valve of the pulmonary artery. *f*, Fossa ovalis.

in the space between the 5th and 6th ribs, a little below and to the right of the left nipple. The right auricle communicates with the right ventricle, besides which there are in it three openings, that of the vena cava inferior, that of the vena cava superior, and that of the coronary vein. The communication between this auricle and ventricle is closed by a valve when the ventricle contracts. The right ventricle communicates with the pulmonary artery, the opening into the artery being guarded by a valve formed of three flaps. When these are brought together they interrupt the communication between the ventricle, and the artery. The left auricle communicates through a valved opening with the left ventricle, and contains the orifices of the four pulmonary veins. The left ventricle, besides the communication with the left auricle, contains the orifice of the aorta, also provided with a valve similar to that of the pulmonary artery. The auricles and ventricle of one side are separated from those of the other by a complete muscular partition, the septum cordis. The valves at the openings of the arteries are called semilunar, that at the orifice of the right auricle tricuspid, that at the orifice of the left auricle mitral, and that at the orifice of the vena cava inferior the Eustachian valve. The heart is formed of a firm thick muscular tissue, composed of fibers interlacing so as to form a figure of eight. It also contains nerves and vessels. The arteries carry the blood from the heart to all parts of the body. They terminate in the capillary vessels, a series of extremely minute tubes which pass over into the veins. The veins are the channels by which the blood passes back from the body to the right auricle of the heart. The blood which is returned from the veins is purplish red, from excess of carbonic acid gas and deficiency in oxygen, and is called venous; that which leaves the heart is bright red, being oxygenated, and is called arterial. The venous blood parts with its excess of carbonic acid and receives new supplies of oxygen in the capillary system of the lungs, flows into the pulmonary veins, thence into the left cavities of the heart, thence it passes into the aorta, and is transmitted to all parts of the body, returning to the veins by the capillary system. It is now become venous, passes through the veins from the extrimities toward the heart, receiving the chyle and the lymph, and is emptied into the right cavities of that organ, which returns it through the pulmonary artery to the capillary vessels of the lungs, where it is subjected to the influence of the air, resumes the qualities of red or arterial blood, and is ready for a new course.

The mechanism of the circulation is as follows:—The blood contained in the two venæ cavæ is poured into the right auricle, which contracts, and thus forces the fluid to escape; but the venæ cavæ oppose to its backward passage the column of blood which they contain, and it must therefore pass into the right ventricle. The ventricle then contracts, and the tricuspid valve closing the passage through which the liquid entered, it is forced into the pulmonary artery, along which it must flow (return to the ventricle being prevented by the semilunar valve) into the capillary system of the lungs, whence it passes into the pulmonary veins, which pour it into the left auricle by four orifices. The contraction of the auricle impels it into the left ventricle, by which it is driven forward into the aorta (the mitral valve preventing its return into the auricle), and thence into the general circulation. The two auricles contract and relax simultaneously with each other, as do also the two ventricles. The relaxation is called diastole; the contractian systole. The quantity of blood projected at each systole is generally estimated at six ounces. The causes of the alternate contraction and relaxation are entirely involuntary and dependent on the nervous system to a large extent. The systole of the ventricles is the cause of the motion of the blood in the arteries, which dilate with each wave driven into them.

The heart is the seat of various and generally dangerous diseases. One of these is pericarditis or inflammation of the pericardium, the double lining membrane or bag enveloping the heart. The

cause of this disease may be exposure to cold, or an injury, or it may be complicated with other diseases. Inflammation of the inner lining is termed endocarditis. Valvular disease is a common affection, of the heart, the valves becoming thickened, contracted, rigid, or otherwise affected, so that they cannot properly perform their duty. The mitral valve, for instance, may become too narrow and contracted, and the result is that all the blood does not pass into the aorta. In other cases of valvular disease, the same result follows, viz., imperfect depletion of the ventricles and auricles, the return of blood being termed regurgitation. The heart consequently becomes weakened, while the entire system suffers. Overgrowth or hypertrophy and dilation are frequent results of valvular disease. In such cases the avoidance of violent exercises and emotions is necessary. The use of digitalis is often successful in strengthening and soothing the heart. Certain diseases produce atrophy, in which the heart becomes feeble in action, while fatty degeneration occurs, when the muscular fibers are replaced by oleaginous particles. This renders the heart peculiarly liable to rupture under any strain or violent emotion, hence such should be carefully avoided by patients. Among other organic diseases of the heart are angina pectoris (the cause of which is uncertain), distinguished by a sense of strangling or suffocation in the breast. Neuralgia of the heart is similar in symptons to angina. A very common heart ailment is palpitation, often caused by indigestion, and the excessive use of tea and tobacco. Syncope or fainting results from the sudden cessation of the heart's action, and may be caused by excitement, emotion or shock of some kind. Some of the above forms of heart disease can be discovered only by auscultation or percussion; others are very evident to non-professional observers.

HEAT, the name given to a peculiar sensation, and also to the agent which produces it, this being now believed to be a certain motion in the minute molecules of which all bodies are composed.

One of the most obvious effects of heat is to alter the temperature of bodies. In almost all cases when heat is supplied to a body, the temperature of the body rises, and when heat is removed the temperature of the body falls. If the increase of temperature is evident, and such as may be noted by the thermometer, the heat is then termed sensible; if not, as in the case of ice immediately melted, it is termed latent. Temperature is, in fact, the tendency that a body has to impart heat to other bodies. If two bodies impart no heat to each other when in contact, they are said to have the same temperature. When the one possesses more heat than the other there is an impartation of heat from the former until the temperature is equalized. Different bodies require very different amounts of heat in order to raise their temperature through the same number of degrees. Thus it requires about thirty times as much heat to raise the temperature of 1 lb. of water 1° as to raise the temperature of 1 lb. of mercury by the same amount. The terms capacity for heat and specific heat are used in relation to this property of bodies. The capacity for heat of a body is the quantity of heat required to raise its temperature 1° from some fixed point, as from 0° C., or from 32° Fah. The specific heat of a substance is the ratio between the quantity of heat required to raise the temperature of the substance 1° from some fixed point and the quantity of heat required to raise the temperature of an equal mass of distilled water 1° from O° C.

Heat changes the dimensions of bodies. Increase of volume is the normal effect, although the reverse is observed in water between O° C. and 4° C., and in iron and bismuth. Between moderate limits bodies expand nearly regularly with the temperature, but this does not hold good of the more extreme limits. (See Expansion.) Addition of heat liquefies solid bodies, and converts liquids into gases. During the conversion of a solid into a liquid, or a liquid into a gas, a considerable quantity of heat is absorbed, and in the reverse process heat is given out; but this is one of the cases in which, though heat is taken in or given out, the temperature is not altered. Hence the heat is said to be made latent. Heat also alters the power of bodies for conducting electricity. In solids the conductivity is diminished to a great extent by an increase of a few degrees in the temperature. In liquids, on the other hand, increase of temperature increases the conductivity. The magnetic properties of bodies are also changed by heat. For example, an iron bar that has been magnetized suddenly loses the whole of its magnetism at a particular temperature. Heat possesses the power of altering the chemical properties of bodies. In some cases it breaks up chemical compounds, but in general it favors chemical combination.

In measuring quantities of heat various units may be adopted, as, for instance, the quantity necessary to melt a pound of ice. But the unit quantity of heat now generally fixed on (the Centigrade thermometer and metrical system being employed) is the quantity of heat which will raise the temperature of 1 gramme of distilled water from O° C. to 1° C.; or 1 lb. of water may be used instead of 1 gramme, and one degree Fahrenheit instead of one degree Centigrade. Calorimetry is the technical name given to the part of the subject that deals with the practical measurement of quantities of heat.

When heat is applied to one end of a bar of iron it is propagated through the substance of the bar, producing a rise of temperature which is first perceptible at near, and afterward at remote portions. This transmission of heat is called conductivity. The best conductors are metals, but all bodies conduct more or less. The best conductor is silver, next follow in order of their conductivity copper, gold, brass, zinc, tin, steel, iron, lead. With the exception of mercury and other melted metals, liquids are exceedingly bad conductors of heat. This can be shown by heating the upper part of a column of liquid and observing the variations of temperature below. These will be found to be scarcely perceptible and to be very slowly produced. If the heat were applied below we should have the process called the convection of heat; the lower layers of liquid would rise to the surface, and be replaced by others which would rise in their turn, thus producing a circulation and a general heating of the liquid. When the heat is applied above the expanded layers remain in their place, and the rest of the liquid can be heated by conduction and radiation only.

Radiation of heat consists in the propagation of heat from a hotter body to a colder one through an intervening medium which is not heated during the process. The heat is transmitted by the same medium that transmits light from a luminous body. Radiant heat and light are, in fact, the same thing, namely vibrations of an elastic medium, the luminiferous ether, supposed to fill all space, and they obey the same laws of reflection, refraction, interference, and polarization. They also obey the general laws of wave-motion. A luminous body excites in the ether waves or undulations of a great many different wave-lengths, some of them capable of affecting the eye as light, and others not. Heat rays need not be at all luminous; they may have no light-giving power, but may be what are known as rays of dark heat, capable of being detected by the thermometer, but not perceptible to the eye. Other rays are purely chemical in their effect (as in photography), and are called actinic rays. The general effect of radiation is to equalize the temperature of any system of bodies so placed as to be capable of radiating one to the other. Every body of the system is constantly sending forth heat-rays in all directions, and receiving the heat radiated from the other bodies. But the hotter bodies emit more than they receive, while the colder bodies receive more than they emit, and the temperature of the system is thus gradually equalized. The rapidity or otherwise of radiation differs much in different bodies. The radiation depends on the nature of the surface of the body, and the power of a body to radiate heat is intimately connected with its power of absorbing heat radiated to it, and with its power of reflecting heat. Surfaces that are good radiators are good absorbers, and surfaces that absorb heat readily reflect it badly. Thus, a kettle covered with soot loses, when filled with hot water, heat more rapidly than one with a brightly polished surface. The best absorber of all is a surface covered with a thin coating of lamp-black. Brightly polished metals are the worst absorbers among bodies that are not transparent to radiant heat.

The transmission of radiant heat through various substances is a subject of great importance. In this connection the terms diathermanous and athermanous correspond to transparent and opaque in the case of light. One of the chief diathermanous bodies is rock-salt. Common white glass transmits rays of high refrangibility, stopping those of low refrangibility. Hence its use as a fire-screen. For the greater part of the heat of a common fire is of the dark kind, and is nearly all stopped by the glass; but glass does not screen from the heat of the sun, a great part of which consists of heat of high refrangibility. On

the other hand, smoked rock-salt transmits very little of the heat of high refrangibility, though it is almost perfectly diathermanous to dark heat.

The nature of heat was long a subject of active controversy. The common theory during the 18th century, and in the early part of the 19th was the materialistic, or that by which heat was regarded as an imponderable fluid (caloric), which could permeate all matter, and which, uniting with the particles of bodies, produced the phenomena associated with heat. The materialistic theory was held by Black and Lavoisier, but it was exploded by the experiments of Rumford and Davy. Among the contributions of Davy to the science was his celebrated experiment of rubbing together two pieces of ice, while surrounded by an ice-cold atmosphere, until they melted away completely. He concluded that "the immediate cause of the phenomenon of heat is motion, and the laws of its communication are precisely the same as the laws of the communication of motion." Between 1840 and 1843 Joule conclusively established the truth of this theory—the dynamical theory of heat—by measuring the amount of energy required to produce a definite heating effect, and by showing that the quantity of heat obtained by expending a definite amount of energy in friction is the same whatever is the nature of the body in which the friction takes place. The conclusions arrived at by him are thus given:—

1st. The quantity of heat produced by the friction of bodies, whether solid or liquid, is always proportional to the quantity of work expended.

2d. The quantity of heat capable of increasing the temperature of 1 lb. of water by 1° Fah. requires for its evolution the expenditure of mechanical energy represented by the fall of 772 lbs. through 1 foot. This amount of energy or work, equal to 772 foot-pounds, is called the dynamical equivalent of heat.

HEAT SPECTRUM, the part of the spectrum from an incandescent body that contains invisible heat rays. To produce to the heat spectrum properly lenses and prisms of rock-salt must be employed. When the spectrum from the sun is examined it is found that the maximum heat intensity is in the dark-heat spectrum at a considerable distance from the place where light ceases to be perceptible.

HEAVEN (probably signifying that which is heaved up or elevated), in a physical sense, the azure vault which spreads above us like a hollow hemisphere, and appears to rest on the earth at the horizon. It is in reality merely the appearance presented to us by the immeasurable space in which the heavenly bodies move. According to some its azure color is due to the light of the celestial bodies reflected from the earth to the air, and thence back again. According to others the reflection is not from the air, but from its contained vapors. A theory recently broached assigns the azure color to the presence of particles of dust in the air. In theology, this word denotes a region of the universe where God's presence is especially manifested, in contrast with the earth. According to the Hebrew scriptures heaven consisted of three regions:—(1) That of the clouds, or air; (2) that of the stars; and (3) the abode of God. They also divide it into two parts, "The Heaven". and the "Heaven of Heavens." Among the Greeks the gods were supposed to reside on Olympus, and the classic poets placed the abode of the just in the Elysian fields. The heaven of Islam is a scene of sensuous enjoyment, while that of the Buddhist consists in Nirvana, regarded by some as meaning the absorption of individual existence in the great ocean of being. The ancient German had his Walhalla, and the American Indian has his happy hunting grounds. Among Christians the general opinion is that heaven is the residence of the Most High, the holy angels, and the spirits of just men made perfect, that this abode is eternal, and its joys intensely spiritual.

HEAVES, or **BROKEN WIND,** a disease or unsoundness of the respiratory organs of the horse.

A broken-winded horse is lean, and has a dependent belly, the muscles of which are usually active as expiratory muscles. The symptoms are best observed when the horse is exercised. The breathing becomes labored, the nostrils dilated, the eyes bloodshot. On watching the chest and flank, the ribs are observed very actively moved, and after collapsing, when the air is expelled from the lungs, are further depressed by a spasmodic jerk brought about by the abdominal muscles. It has a hollow cough and when the animal is oppressed by fast work, or by dragging a load up a hill, the pulse is excessively rapid, a symptom regarded by some as indicating disease of the heart, and by others an affected diaphragm. It is a dietetic disease, due to the irritation in the stomach caused by indigestible food. On post-mortem examination the stomach is found to be much distended with food of a dry nature, and to have thinner walls than is normal. The lungs are lighter in color, and float much more buoyantly than in health; little or no blood is seen in them, but they contain a large quantity of air, which makes them crackle when pressed.

The treatment of heaves is very unsatisfactory, and a palliation of the symptoms by keeping the alimentary canal in proper order, administering occasional purgatives, and feeding on a proper quantity of the best oats, which should always be bruised, are all that can be recommended as remedies; but turning out to pasture, or feeding on cornstalks or other laxative food, sometimes produced a cure in mild cases. Only the best quality of hay should be fed, and that in small quantities.

HEBE, in Greek mythology, the goddess of youth, and the cupbearer to the gods, until replaced by Ganymede; a daughter of Zeus and Hera, who gave her as a wife to Heracles. In the arts she is represented with the cup in which she presents the nectar, under the figure of a charming young girl, her dress adorned with roses, and wearing a wreath of flowers.

HEBER, Reginald, D.D., an English poet and bishop, was born 1783, died 1826. In addition to his hymns, his best known productions are Palestine; an edition of the works of Jeremy Taylor (with Life); Poems and Translations.

Hēbē, statue by Canova.

HEBERT (ā-bār), Jacques René, notorious during the French revolution, was born at Alencon in 1757, executed 1794. Having denounced Danton, the latter, in conjunction with Robespierre, secured his destruction by the guillotine in 1794.

HEBREW LANGUAGE AND LITERATURE, the language and literature of the Jews, Israelites, or Hebrews, especially at that period when they formed a compact nation inhabiting Canaan or Palestine. (For a sketch of the history of the people see Jews.) The Hebrew language forms a branch of the Semitic family of languages, being akin to the Aramaic (Chaldee and Syriac), Arabic, Ethiopic, and Assyrian. In the antiquity of its extant literary remains Hebrew far surpasses the other Semitic idioms, and in richness and development is only inferior to the Arabic. The language is deficient in grammatical technicalities, specially in moods and tenses of the verb, in the absence of the neuter gender, etc. Its roots are triliteral (consisting of three consonants), and words are derived from them by the reduplication of the letters of the root, and by the addition of formative elements before and after the roots. The alphabet is composed of twenty-two consonants, the vowels being expressed by marks above or below these letters. The accents and marks of punctuation amount to about forty. The writing is from right to left. There are three kinds of Hebrew alphabet now in use—the square or Assyrian (properly called the Babylonian), the most common; the rabbinical, or mediæval; and the cursive, or alphabet used in ordinary writing.

HEBREWS, Epistle to the, one of the books of the New Testament, the canonicity and authorship of which have been much discussed. The immediate successors of the apostles (Clement of Rome, Justin Martyr, etc.) seem to have considered it as of canonical authority. Its canonicity was also maintained by St. Jerome, by the almost universal consent of the Latin and Greek churches, and by Ambrose of Milan; while in 416 a decretal of Innocent III. was issued in favor of this view. As to the authorship, the early Roman church denied its Pauline origin.

HEB'RIDES, or **WESTERN ISLANDS** (the Heboudai of Ptolemy, and Hebudes of Pliny, the r being an erroneous inser-

tion), a series of islands and islets off the west coast of Scotland, usually divided into the Outer Hebrides (popularly called the Long Island), of which the principal are Lewis and Harris, North Uist, Bengecula, South Uist, and Barra; and the Inner Hebrides—Skye, Mull, Islay, Jura, Coll, Rum, Tiree, Colonsay, etc. The islands within the Firth of Clyde (Arran, Bute, the Cumbraes, etc.) are not now considered as part of the Hebrides. They number upward of 400 in all, but only about 90 are inhabited; area, about 2800 sq. miles; pop. 79,159.

HEC'ATOMB, an ancient Greek worship literally a sacrifice of a hundred oxen, but applied generally to the sacrifice of any large number. It was necessary that the victims should be without blemish. Only parts such as the thighs, legs, or hide were burned, the rest furnishing the festive meal at the close of the sacrifice.

HECLA, or **HEKLA,** a volcano of Iceland, about 20 miles from its southwest coast, about 5000 feet in height, and having several craters. It is composed chiefly of basalt and lava, and is always covered with snow. Many eruptions are on record. One of the most tremendous occurred in 1783, after which the volcano remained quiescent till September, 1845, when it again became active, and continued with little intermission till November, 1846, to discharge ashes, some masses of pumice-stone, and a torrent of lava. The last outbreak was in 1878.

HECTOR, the son of Priam and Hecuba, the bravest of the Trojans, whose forces he commanded. His wife was Andromache. His exploits are celebrated in the Iliad. Having slain Patroclus, the friend of Achilles, the latter sought revenge, and Hector was slain by him. The body of Hector was dragged at the chariot wheels of the conqueror; but afterward it was delivered to Priam for a ransom, who gave it a solemn burial. Hector is the most attractive warrior in Homer's Iliad, in which one of the finest episodes is his parting from Andromache before his last combat.

HEC'UBA, of Phrygia, in Greek legend the second wife of Priam, king of Troy, to whom she bore Hector, Paris, Cassandra, Troilus, and other children. After the fall of Troy she was given as a slave to Odysseus, and, according to one form of the legend, in despair leaped into the Hellespont.

HEDGEHOG, an insectivorous animal, covered with spines in lieu of hair.

Hedgehog.

By means of a special muscle it is able to roll itself into a ball, and in this form can defy most of its enemies. It has a rudimentary tail, elongated nose, short ears, with a cranium comparatively broad. The hind feet have five toes, and strong coarse hair covers some parts of the body. The teeth are numerous. Including the tail, it attains a length of 11 inches. It usually resides in small thickets, and feeds on fruits, roots, and insects. It is fond of raw or roasted flesh, and devours cockroaches in large numbers when kept in houses. It hibernates in winter. The female bears four to eight young at a birth, the young soon becoming covered with prickles.

HEDGE-WARBLER, or **HEDGE-SPARROW,** a bird common in the British Islands and all the temperate parts of Europe. The song of the male is short and plaintive. The length of the bird is about 5½ inches.

HEGEL (hā'gl), Georg Wilhelm Friedrich, a celebrated German metaphysician, born at Stuttgart 1770, died 1831. Among his works the most important are his Phänomenologie des Geistes (1807), Wissenschaft der Logik (1812-16), Encyclopädie der Philosophischen Wissenschaften (1817), and Grundlinien der Philosophie des Rechts oder Naturrecht und Staatswissenschaft (1821).

HEIDELBERG (hī'dl-berg), a town of Baden, beautifully situated on the left bank of the Neckar, here crossed by two bridges, in one of the loveliest districts of Germany. The principal buildings are: the church of St. Peter; the church of the Holy Ghost; the castle, anciently the residence of the Electors Palatine; the university founded in 1386, and now possessed of a library of 500,000 volumes and attended by about 1000 students; the town-house, etc. The castle, begun in the end of the 13th century, and exhibiting elaborate examples of early and late renaissance architecture, is the most remarkable edifice in Heidelberg. It is now an ivy-clad ruin, but is carefully preserved from further decay. The principal industry is brewing. One of the greatest curiosities of the place is the Heidelberg tun, kept in a cellar under the castle. It is 36 feet in length, 26 in diameter, and capable of holding 800 hogsheads. Pop. 40,121.

Castle and town of Heidelberg.

HEIGHTS, Measurement of, or Hypsometry, is that department of geodesy which treats of the measurements of the absolute or relative heights of various points on the earth's surface. In all cases in which great accuracy is essential, trigonometrical methods must be employed, but in other cases sufficiently accurate results may be obtained by levelling, by the use of the barometer, or by the boiling-point of water as given by the thermometer. The trigonometrical method is often the only one available, as the height to be measured may be quite inaccessible. The barometric method is based on the fact that as the mercurial column is supported by the atmospheric pressure, it must fall when conveyed from a lower to a higher level, as in the latter case the pressure is diminished. Were the atmosphere uniform in density throughout, nothing could be simpler than the measurement of heights by the barometer, but gases being very compressible, the lower strata of the atmosphere are denser than the upper strata, being exposed to greater pressure. Thus a column of air 100 feet high, has far greater weight at the sea-level than a similar column at the top of a mountain 4000 feet high; and the effect on the barometric column of rising 100 feet from sea-level is corresponding greater than the effect of rising 100 feet from a height of 4000 feet above the level of the sea. Moreover, increase of temperature affects the density of the mercury in the barometer, and also that of the air, and further complicates the problem. Hence for the greatest accuracy in determining the difference of levels two mercurial barometers and four thermometers are required. Two of the thermometers are used for determining the temperature of the air at the stations, and two are attached to the barometers for determining the temperature of the mercury. The observations are made simultaneously. The aneroid barometer is in some respects more suitable than the mercurial, being much more portable, and requiring two thermometers only. After the necessary observations are made the

required height may be calculated by the use of certain logarithmic formulæ, or by the rough method stated under Barometer. Tables obviating the use of logarithms are often supplied by instrument makers along with aneroid barometers. The method in which use is made of the principle that water boils at the temperature of 212° under the full pressure of the atmosphere but at a lower temperature with a smaller atmospheric pressure, such as is given by an elevated position, is simple and sufficiently accurate for many purposes. It has been found that if water at the sea-level boils at 212° on rising 510 feet it will boil at 211°, and so on.

HEINE (hī'nė), Heinrich, a German poet and author, was born of Jewish parents at Düsseldorf, 13th December, 1799, and died at Paris 17th Feb., 1856. Of the numerous literary works of Heine may be mentioned in particular Gedichte (Poems); Reisebilder (Pictures of Travel); Buch der Lieder (Book of Songs); Deutschland Ein Wintermärchen (Germany, a Winter Tale); Shakespeare's Mädchen und Frauen (Maidens and Wives); Die Romantische Schule; Letzte Gedichte und Gedanken (Last Poems and Thoughts); Atta Troll; Romanzero, etc.

HEIR-APPARENT, the person who necessarily succeeds to the ancestor if he survives him, because no other person can ever gain precedence over him, as an eldest son. Compare Heir-presumptive.

HEIR-PRESUMPTIVE, is one who, if the ancestor should die immediately, would, under existing circumstances, be his heir, but whose right of inheritance may be defeated by some nearer heir being born, as an only daughter, who is displaced by the birth of a son. Compare Heir-apparent.

HEJRA, HEJIRA, or **HEGIRA,** an Arabic word signifying emigration. The Mohammedans designate by it the flight of Mohammed their prophet from Mecca to Medina. From this flight, which happened on the 13th of September, 622 A.D., but which they fix on the 16th of July, of the same year, they begin their computation of time.

HELEN, or **HEL'ENA,** in ancient Greek legend, the most beautiful woman of her age, daughter of Zeus by Leda. By advice of Ulysses her numerous suitors were bound by oath to respect her choice of a husband, and to maintain it even by arms. She chose Menelaus, but was afterward carried off to Troy by Paris, the Trojan war arising from the claim made by Menelaus for the fulfilment of the oath. After the death of Paris she married his brother Deiphobus. On the fall of Troy she returned to Sparta with Menelaus, but at his death was driven from the country, and was murdered at Rhodes by the queen of the island.

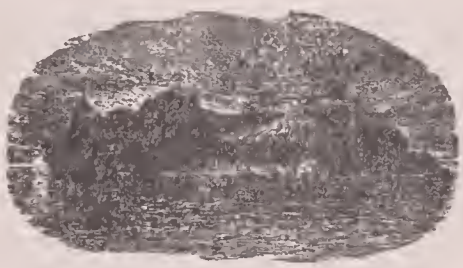
HEL'ENA, the name of several saints, of whom the chief was the mother of the Emperor Constantine the Great, a woman of humble origin, and a native either of Bithynia or of Britain.

HELENA, the capital of Montana, on the w. side of the valley of Prickly Pear, and Ten Mile creeks, at the foot of the Rocky Mountains, 15 miles w. of Missouri river, and 110 miles n. of Virginia City. It is chiefly supported by the rich quartz and placer gold mines in the

State capitol, Helena, Mont.

vicinity. In the vicinity are hot medicinal springs. Pop. 16,464.

HELE'NA, St., an island in the South Atlantic, belonging to Britain, about 850 miles southeast of the island of Ascension, 1150 miles west from the west coast of South Africa, and 2000 miles from the east coast of Brazil; greatest length, 10½ miles; greatest breadth, 7 miles; area, about 47 sq. miles. Its position, in the ocean thoroughfare from Europe to the East, has made it a place of call for vessels, while it has acquired special celebrity as the place of



The island of St. Helena.

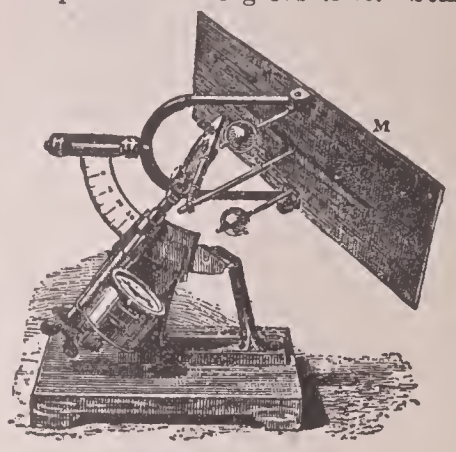
Napoleon's banishment, and where he resided from 1816 till his death in 1821. It has precipitous and almost inaccessible coasts, particularly on the north, where almost perpendicular cliffs rise to from 600 to 1200 feet. The only town on the island is James' Town, which has a fine natural harbor, and affords excellent anchorage in 12 fathoms. Pop. 5195.

HEL'ICON, a mountain range of Greece, in the west of Bœotia, in some sense a continuation of the range of Parnassus. It was the favorite seat of the Muses, who, with Apollo, had temples here. In it also were the fountains of Aganippe and Hippocrene. The highest summit, now called Paleovuni, is barely 5000 feet high.

HELIGOLAND, an island belonging to Germany, in the North Sea, about 40 miles from the mouth of the Elbe; 1¼ mile long and ½ mile broad; highest point, 200 feet. Pop. 2307.

HELIODO'RUS, a Greek romance writer, born at Emesa, in Syria, in the 4th century.

HE'LIOGRAPH, or **HELIOSTAT,** a name given to various contrivances for reflecting the sun's light either temporarily or continuously to an observer at a distance. The simplest heliostat is a mirror hung up at a distant station so as to reflect a flash to the observer whose station may be many miles from it. This mirror is generally so adjusted that the flash occurs exactly at some prearranged hour, and by being in readiness the observer can get an observation with precision as regards time. Some



Heliostat. *M*, mirror.

heliostats are visible for 80 miles. By being fitted with an adjustment of clockwork, the mirror can be made to revolve with the sun, and so to reflect a beam of sunlight steadily in one direction, being then called also heliotrope. The heliostat has been used for signalling in war.

HELIOGRAVURE, or **PHOTOGRAVURE,** is a photo-mechanical printing process. A photograph of any object, as a painting, etc., is taken, and from the negative so obtained a positive print is made on gelatinized paper. This print is transferred upon a highly polished copper plate, and a solution of terchloride of iron is poured upon it, which penetrates through the gelatine and etches the picture upon the copper. The final result is the production, of a photo-etched copper-plate, from which a large number of impressions can be taken.

HELIOM'ETER, an instrument for measuring small distances on the sky, particularly the apparent diameters of the sun and of the moon. It was invented by Bouguer in 1747, and improved by Dollond and Fraunhofer.

HELIOP'OLIS, the On, Rameses, or Beth-shemesh of the Hebrew Scriptures; now called Matarieh; situated a little north of Memphis, and one of the most ancient and extensive cities of Egypt under the Pharaohs. It had a magnificent temple dedicated to Re; and communicated with the Nile by lakes and canals. During the flourishing ages of the Egyptian monarchy the priests taught within the precincts of its temples, and both Eudoxus and Plato visited its famous schools. Here Joseph and Mary are said to have rested with the infant Christ. Near the village stands the Pillar of On, supposed to be the oldest Egyptian obelisk, 67½ feet high, and 6 feet broad at base. The Turks were defeated here by the French in 1800.

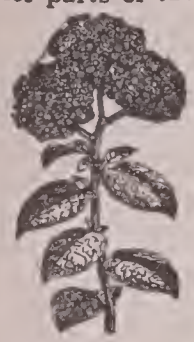
HE'LIOS, the god of the sun (Latin, Sol) in the Greek mythology; son of Hyperion and Theia, and brother of Eos (Aurora, the dawn) and Selēnē (Luna, the moon). He dwells with Eos in the ocean behind Colchis, from which he

issues in the morning, and to which he returns at night. His worship was extensively diffused, and he had temples in Corinth, Argos, Trœzene, Elis, but particularly in Rhodes, the Colossus of which was representation of Helios.

HE'LIOSCOPE, a telescope fitted for viewing the sun without distressing the eyes, as when the image of the sun is received upon mirrors formed simply of surfaces of transparent glass which reflect only a small portion of the light.

HE'LIOSTAT. See Heliograph.

HE'LIOTROPE, a genus of plants, natural order Boraiginaceæ. The species are herbs or undershrubs, mostly natives of the warmer parts of the world, and



Heliotrope.

have alternate leaves and small flower usually disposed in scorpioid cymes. The common heliotrope, is indigenous in the south and west of Europe, and has small white or pale red flowers with a fruit of four drupes under a thin fleshy covering.

HELIOTROPE, the bloodstone, a variety of quartz, partaking of the character of jasper or of chalcedony. It is of a deep green color, and covered with red spots. It is hard, and is used for burnishers; the more finely-marked stones are prized for seals, signet-rings, etc. It is found in Tartary, Persia, Siberia; in the island of Rum, Scotland, and elsewhere. It received the name heliotrope, or elitropia, because it was said that if the mineral were put into water in a basin rubbed with the juice of the plant heliotrope, and were exposed to the sun, the water would appear red and the sun blood-like, as if it were eclipsed. The stone rubbed with the juice of the plant was said to render its wearer invisible.

HE'LIOTYPE, a photographic process by which pictures can be printed in the same manner as lithographs, depending on the fact that a dried film of gelatine and bichromate of potash, when exposed to light, is afterward insoluble in water, while the portion not so exposed swells when steeped. A mixture of gelatine, bichromate of potash, chrome alum, and water is poured on a plate of glass, where it shortly settles into a film. When dried the film contracts and separates from the glass. A picture is then printed on it from a negative, after which it is attached to a plate of zinc, and copies are taken from it by inking it with lithographic ink exactly as in the ordinary lithographic process. The films are technically called "skins." Sometimes a gutta-percha mould is prepared from the film, and copper deposited on it by the electrotype process, the plate thus produced being printed from in the ordinary way.

HELIX, (1) a spiral line as of wire in a coil, or such a curve as is described by every point of a screw that is turned round in a fixed nut. (2) In arch. a small

Helices of corinthian capital.

volute or twist under the abacus of the Corinthian capital, of which in every perfect capital there are sixteen, two at each angle, and two meeting under the middle of each face of the abacus.

HELL, signifies originally the covered or invisible place. In the English Bible the word is used to translate the Hebrew Sheol (grave or pit) and Gehenna (properly the valley of Hinnom), as well as the Greek Hades (the unseen). In the Revised Version of the New Testament, however, hell is used only to translate Gehenna, Hades being left where it stands in the Greek. In common usage hell signfies the place of punishment of the wicked after death, its earlier meaning being lost. The distinctive Scripture term for the place of future punishment of the wicked is Gehenna, which, unlike Sheol and Hades, never has an intermediate signification; and Christ adopting on this point the current language of the time gave the sanction of his authority to the leading ideas involved in it. Gehenna, or hell, is with him the place of final torment. The Eastern and Western churches are as one as to the punishment of hell being partly "a pain of loss," that is, the consciousness of being debarred the presence of God, and partly a "pain of sense," that is, real physical suffering. The prevailing idea among modern theologians is that the "fire" and the "worm" are significant emblems to give us the most correct and living conceptions of the reality that we can possibly attain in our present circumstances.

HEL'LEBORE, a genus of plants, consisting of perennial low-growing plants with palmate or pedate leathery leaves,

Black hellebore or Christmas-rose.

yellowish, greenish, or white flowers, having five conspicuous persistent sepals, eight to ten small tubular petals, and several many-seeded carpels.

HELL GATE, a formerly dangerous pass in East river, the strait which connects New York bay with Long Island sound. Rocks here used to form an obstruction much dreaded by mariners, but by extensive submarine mining operations and the use of the most powerful explosives, the passage has been practically cleared.

HELM, the contrivance by which a vessel is steered, usually composed of three parts, viz., the rudder, the tiller, and the wheel, except in small vessels, where the wheel is unnecessary. See Steering.

HELMET, an article of armor for the protection of the head, composed of leather or of metals. Some of Homer's heroes are represented as wearing brazen helmets, with towering crests. Among the Romans the cassis was a metallic helmet; the galea, a leathern one. The earlier Greek and Roman helmets did not protect the face. During the middle ages helmets were made of steel, frequently inlaid with gold, and provided with bars and flaps to cover the face in battle and to allow of being opened at other times. The full-barred helmet entirely covered the head, face, and neck, having in front perforations for the admission of air, and slits through which the wearer might see the objects around him. The open helmet covered only the head, ears, and neck, leaving the face unguarded. Some open helmets had a bar or bars from the forehead to the chin, to

Full-barred helmet,

Open helmet.

guard against the transverse cut of a broadsword. The modern military helmets afford no protection for the face. Firemen wear a heavy headpiece of leather and brass, or other materials, to protect them as far as possible from falling ruins at conflagrations. Helmets of white felt, with folds of linen wrapped round them, are worn in India and other hot climates as a protection against the sun. The name helmet is also given to a kind of hat worn by policemen. In heraldry the helmet is borne over a coat of arms, and the form and position of it vary according to the quality or dignity of the bearer. See Heraldry.

HELMHOLTZ, Hermann-Ludwig Ferdinand, German physiologist and physicist, born 1821 at Potsdam, and educated at Berlin. His work has been chiefly in those departments of physics which are in closest relation with physiology, notably in acoustics and optics. Of his many publications the best known are: The Conservation of Force (1847), Manual of Optics (1856–66), Popular Lectures on Scientific Subjects (London, 1873 and 1881), and Sensations of Tone as a Physiological Basis for the Theory of Music (1862, London 1875). He was ennobled by the German emperor in 1883. He died in 1894.

HELMONT, John Baptist Van, born in 1577 at Brussels; in his seventeenth year gave public lectures on surgery at Louvain. He was probably the first to introduce the term gas into science, and was also first to observe the acid re-

action of the gastric juice. He died in 1864.

HELOISE, Eloise (el-o-ēz), celebrated for her beauty and wit, but still more on account of her love for Abelard; was born in Paris in 1101. After the mutilation of her lover she was persuaded by him to take the veil at Argenteuil, and ulimately became prioress of the convent there until 1129, when she entered, with some of her nuns, the oratory of the Paraclete, built by Abelard at Nogent-on-the-Seine, where she lived in exemplary piety. She died in 1164. Contemporary writers speak in high terms of her genius. She understood Latin, Greek, Hebrew, was familiar with the ancients, and well read in philosophy and theology.

HE'LOTS, slaves in ancient Sparta. They were the property of the state, which alone had the disposal of their life and freedom, and which assigned them to certain citizens, by whom they were employed in private labors. They several times rose against their masters, but were always and finally reduced.

HELSINGFORS, a seaport of Russia, capital of Finland, on a peninsula in the gulf of that name, 180 miles w. n. w. St. Petersburg. Pop. 88,711.

HELVETIUS, Claude Adrien, French philosophical writer, born in 1715. In 1758 he published his one important book, De l'Esprit (On the Mind), the materialism of which drew upon him many attacks. It was condemned by the Sorbonne, and publicly burned by decree of the parliament of Paris. He died in 1771 in Paris. He also wrote a work, De l'Homme, and an allegorical poem, Le Bonheur.

HE'MANS, Felicia Dorothea, English poetess, born at Liverpool in 1793; maiden name Brown. Her death took place in 1835. Her poetry is essentially lyrical and descriptive, and is always sweet, natural, and pleasing. In her earlier pieces she was imitative, but she ultimately asserted her independence, and produced many short poems of great beauty and pathos, and evidently destined to live.

HEM'ATINE, or **HÆMATINE,** the red coloring matter of the blood occurring in solution in the interior of the blood corpuscles or cells. It is the only structure of the body, except hair, which contains iron.

HEM'ATITE, a name applied to two ores of iron, red hematite and brown hematite. They are both of a fibrous structure, and the fibers, though sometimes nearly parallel, usually diverge or even radiate from a center. They rarely occur amorphous, but almost always in concretions, reniform, globular, botryoidal, stalactitic, etc. The red hematite is a variety of the red oxide, and is one of the most important iron-ores. The brown hematite is a variety of the brown oxide or hydrate; its streak and powder are always of a brownish yellow. See Iron.

HEM'ISPHERE, half a sphere, especially one of the halves into which the earth may be supposed to be divided. It is common to speak of the eastern hemisphere and the western hemisphere, the former, also called the Old World, comprising Europe, Asia, Africa, Australia, etc.; the latter, North and South America, etc. The boundary between the two is quite arbitrary, and a more natural division of the earth is into the northern and the southern hemisphere, the equator forming the dividing line.

HEMLOCK, a poisonous plant, supposed to be identical with the plant kōneion of the Greeks. It is a tall, erect, branching biennial, with a smooth, shining, hollow stem, usually marked with purplish spots, elegant, much-divided leaves, which when bruised emit a nauseous odor, and white flowers in compound umbels of ten or more rays, surrounded by a general involucre of three to seven leaflets. It is found in Britain and throughout Europe and temperate Asia in waste places, banks, and under walls. It is said to be fatal to cows when they eat it, but that horses, goats, and sheep may feed upon it without danger. In the human subject it causes paralysis, convulsions, and death. The poison administered to Socrates is supposed to have been a decoction of it, though others are of opinion that the potion was obtained from water-hemlock (Cicūta virōsa). Hemlock is a powerful sedative, and is used medicinally. The extract is considered the best preparation. It is often serviceable as a substitute for, or an accompaniment to opium. It has been found very useful in chronic rheumatism and in whooping-cough, allaying the pain of irritable sores and cancerous ulcers. The virtues of hemlock reside in an alkaline principle termed conia or coniine.

Hemlock.

HEMLOCK, or **HEMLOCK SPRUCE,** a name given to an American fir from its branches resembling in tenuity and position the common hemlock.

HEM'ORRHAGE, a flux of blood from the vessels containing it whether from a rupture or any other cause. A hemorrhage from the lungs is called hemoptysis; from the urinary organs, hematuria; from the stomach, hematemesis; from the nose, epistaxis; the treatment of course varying with the cause and seat of the mischief.

HEM'ORRHOIDS, signifying an affection of the rectum, otherwise called piles. In general, hemorrhoids manifest themselves between the period of puberty and old age, although infants and aged people are not entirely exempt from attacks. In some cases they appear to be the effect of a certain hereditary disposition, but any circumstance which produces a tendency or stagnation of the blood at the extremity of the rectum is to be reckoned among the local causes. The accumulation of fecal matter in the intestines, efforts to expel urine, the obstruction of any of the viscera, especially of the liver, the frequent use of hot bathing, of drastic purges, long continuance in a sitting posture, riding on horseback, pregnancy—such are some of the ordinary causes of hemorrhoids. They are distinguished into several sorts, as external, when apparent at the anus; internal, when concealed within the orifice; blind or open, regular or irregular, active or passive, periodical or anomalous, etc. The best mode of treatment is to recur to hygienic rather than medicinal influences. The subject should avoid violent exercise; the food should not be too stimulating or nutritious. Traveling, or an active life, should succeed to sedentary habits. Constipation should be remedied by laxatives or gentle purgatives. Any thing which may be productive of a local heat should be avoided; as warm seats, soft beds, too much sleep. If the pain is considerable recourse should be had to sedatives, gentle bleeding, leeches. The use of suppositories containnig drugs, such as tannic acid or extract of witch-hazel (hazeline), will be found very useful; in mild cases iodoform suppositories may be curative. If the disease appears under a more severe form a surgical operation may become necessary.

HEMP, an annual herbaceous plant. The hemp fiber is tough and strong, and peculiarly adapted for weaving into coarse fabrics such as sail-cloth, and for twisting into ropes and cables. Immense quantities are exported from Russia. The finer sorts are used for shirtings, sheetings, etc., which, though coarser than that made from flax, are very much stronger and equally susceptible of being bleached. The hemp of England is very superior, but the plant does not pay the farmer, and very little of it is grown. In some of the United States it is a crop of considerable importance. The seed must be sown thin, not more than 1 to 2 bushels to an acre. Small paths are often left open along the field lengthwise, at about 7 feet distant from each other, to allow the plucking of the male plants first, as the female require to remain standing a month longer to admit of the seed becoming ripe. But in some parts the whole crop is cut at once, plants for seed being separately cultivated. The plant being stripped of its leaves, and dried in the open air, may be stored, but when steeped green it turns out of a better color. The steeping takes from four to eleven days, and the operation is known to be completed by the inner reed or woody fiber separating easily from the fibers of the outer bark. When thoroughl

Hemp.

steeped it is taken out of the water and spread out in rows on the grass to bleach. This takes three weeks or more, during which period it requires constant turning with a light, long pole. After drying it is scutched or broken by breaks and scutching-stocks, resembling those employed for flax. Beating is the next operation, which separates the "boon" from the fiber. The hemp is now ready for being heckled, after which it may be spun. Hemp-seed is much used as food for cage-birds, and also yields an oil. Sisal hemp or "henequen" and Manila hemp are not true hemps.

HENBANE, a plant of Europe and Northern Asia. It is a coarse erect biennial herb, found in waste ground and loose dry soil, having soft, clammy, hairy foliage of disagreeable odor, pale yellowish-brown flowers streaked with purple

Henbane.

veins, and a five-toothed calyx. The expressed juice of the leaves and seeds is often used as a sedative, antispasmodic, and narcotic, having in many cases the great advantage over laudanum of not producing constipation. When taken in considerable quantity it proves quickly fatal to man and most animals, particularly to domestic fowls, whence the name. Called also Stinking Nightshade.

HENDERSON, the county seat of Henderson co., Ky., on the Ohio river, and the Lv. and N., the Lv., St. L. and Tex., and the Ohio Val. railways; 143 miles w. s. w. of Louisville. It has large tobacco-stemming interests, a cotton-mill, woolen-mill, whisky distilleries, foundry, carriage and wagon factories. Pop. 12,120.

HENDERSON, David Bremner, American statesman, born at Old Deer, Aberdeenshire, Scotland, in 1840. He went to Illinois in 1846, to Iowa in 1849, graduated at Upper Iowa university, studied law in an office at Dubuque, and was admitted to the bar in 1865. In 1861 he enlisted as a private in the Twelfth Regiment Iowa volunteer infantry, was elected and commissioned first lieutenant of Company C, and served until discharged, February 26, 1863, owing to the loss of a leg at the battle of Corinth. He was elected to the Federal house of representatives in 1882, as a republican from the Third Iowa district, was chairman of the committee on judiciary, and a member of committee on rules in the fifty-fourth and fifty-fifth congresses, and in 1899, at the organization of the fifty-sixth congress, was elected speaker of the house. He was also chairman of the Iowa delegation at three national republican conventions. Died 1906.

HEN'DRICKS, Thomas Andrews, American politician, was born near Zanesville, Ohio, in 1819, was a member of the Indiana legislature and the state constitutional convention of 1851; was a member of congress from 1851 to 1855. United States senator from 1863 to 1869, and in 1868 was a candidate for the democratic nomination for president. He was governor of Indiana from 1873 to 1877. He ran for vice-president of the United States on the ticket with Samuel J. Tilden in 1876, and was elected vice-president in 1884 on the ticket with Grover Cleveland. He died in 1885.

HEN-HAWK, the species commonly called hen-hawks include two birds, the red-tailed and the red-shouldered hawk. The redtail is one of the largest, most numerous, and most widely distributed of North American buzzard-hawks. It is from 19 to 25 inches long, and its spread of wings is from 49 to 58 inches. In maturity the upper surface is blackish-brown, variegated with whitish and dull rust-color, the last tint growing brighter on the upper surface of the tail, which has a blackish cross-band near the end. The under surface of the body is buffy white, the belly marked with dark streaks. The majority of them leave the northern states in winter, and migrate in large flocks. They build their nests in tall trees. Their food includes all the mammals from size of a squirrel downward, and all sorts of birds from grouse and rails to sparrows; but this larger game is far outnumbered by the smaller gophers, mice, frogs, insects, and carrion upon which they principally subsist.

The red-shouldered hawk, is a species rather less in size than the redtail, and generally more reddish in plumage, especially bright on the shoulders, while the lower parts (whitish in the young) are everywhere rusty in color, transversely barred with a darker tint. The tail is black, covered by about six bands of white. It is a rather heavy, sluggish bird, and lives throughout the year south of the Great Lakes, frequenting lowlands and marshes, except in the spring, when it retires to the woods for breeding purposes. It preys principally on mice, and never attacks poultry, so that its reputation as a hen-hawk is undeserved.

HENNA, a shrub, bearing opposite entire leaves and numerous small white fragrant flowers disposed in terminal panicles. It grows in moist situations throughout North Africa, Arabia, Persia and the East Indies, and has acquired celebrity from being used by the inhabitants of those countries to dye yellow the nails of their fingers and the manes, hoofs, etc., of their horses. It is cultivated extensively in Egypt and the powdered leaves form a large article of export to Persia and the Turkish possessions. It may be used for dyeing woolens, not only yellow, but brown, when alum and sulphate of iron are employed.

Henna plant.

HENRIETTA MARIA, queen of Charles I. of England; youngest child of Henry IV. of France, by his second wife, Maria

Henrietta Maria.

de' Medici; born is Paris 1609. Her bigotry, and despotic ideas as to divine right did much to bring Charles I. to the block. She died in 1669.

HENRY I., of Germany, was born in 876; the son of Otho the Illustrious, duke of Saxony. Henry, on the death of his father, became Duke of Saxony and Thuringia. He was elected emperor of Germany in 919, and was the true founder of the empire. By his prudence and activity Suabia and Bavaria were forced to tender allegiance, and Lorraine was reunited to the German Empire in 925. Besides his military reforms he diminished the feudal privileges, and granted to the cities of the empire their first municipal charters. He died in 936.

HENRY II., the saint, emperor of Germany, born 972, was a son of Henry the Quarreler of Bavaria, and great-grandson of the Emperor Henry I. He inherited Bavaria in 995, and on the death of Otho III. in 1002 laid claim and was elected to the empire. He died in 1024.

HENRY III., Emperor of Germany, the second belonging to the house of the Salian Franks, son of the Emperor Conrad II.; born in 1017; chosen king in 1026; succeeded his father in the imperial dignity 1039. He died in 1055. His first wife was a daughter of Canute the Great of England.

HENRY IV., German emperor, son of Henry III., was born in 1050, and at the death of his father was only five years old. His whole life was a series of troubles, partly of his own causing. His severe treatment of the Saxons led to a rising which was cruelly punished. His treatment of the conquered people was such that they complained to the pope, and Gregory VII. (Hildebrand), accordingly summoned Henry, in 1076, to ap-

pear before him at Rome and answer the charges, at the same time forbidding the sale of ecclesiastical dignities. Henry not only disregarded the threat, but instigated the bishops, assembled by his order at Worms, to renounce their obedience to the pope. Gregory, however, pronounced sentence of excommunication against him, and Henry, finding himself deserted, was obliged to go to Italy and make his submission to the pope (1077). Henry IV. ended his life and his sorrows in neglect at Liége in 1106.

HENRY V., Emperor of Germany, the son and successor of Henry IV. (see above), was born in 1081. On his ascension the question of investiture distracted the empire anew. Pope Pascal would only confer the imperial crown upon condition that the rights claimed by Gregory should be formally conceded. Henry therefore seized the pope at the altar and imprisoned him until he yielded two months later, and crowned Henry in April, 1811. He died at Utrecht in 1125 and was the last of the Salic or Frankish family of emperors, which was succeeded by the Suabian house. He married Matilda, a daughter of Henry I. of England.

HENRY VI., German emperor, son of Frederick I. and Beatrice of Burgundy, the third emperor of the house of Hohenstaufen, born in 1165, crowned king in 1169, succeeded his father as emperor in 1190. He kept Richard Cœur de Lion in prison, and obtained a large ransom for him. He died in 1197.

HENRY VII., Emperor of Germany, born in 1262, was chosen emperor in 1308. Among the first acts of his reign were recognition of the independence of the Swiss cantons of Schwyz, Uri, and Unterwalden, and the granting of the kingdom of Bohemia to his son John. He compelled the Milanese to give him the iron crown of Lombardy, suppressed by force the revolt which then broke out in Upper Italy, captured part of Rome, which was in the hands of Neapolitan troops, and was crowned Roman Emperor by two cardinals. He died suddenly in 1313.

HENRY II., King of France, born in 1519, succeeded his father, Francis I., in 1547. Throughout his reign his mistress, Diana of Poitiers, exercised an important influence over king and court. Henry was mortally wounded by a splinter from the lance of Lord Montgomery, captain of the Scottish guard. He was succeeded in 1559 by his eldest son, Francis II.

HENRY III., King of France, third son of Henry II. and Catherine de Medici, born in 1551; succeeded his brother, Charles IX., in 1574. He was the last of the branch of Orléans-Angoulême of the stock of the Valois, and was succeeded by Henry of Navarre, the first of the house of Bourbon.

HENRY IV., King of France was son of Anthony of Bourbon, duke of Vendôme, and of Jeanne d'Albret, daughter of Henry, king of Navarre, and herself afterward queen of Navarre. In 1572 he married Margaret of Valois, sister of Charles IX., and after the massacre of St. Bartholomew, which took place during the marriage festivities, was forced to adopt the Catholic creed. In 1576 he escaped from Paris, retracted at Tours his enforced abjuration of Calvanism, put himself at the head of the Huguenots, and took a leading part in all the subsequent religious wars. He was obliged, however, to raise the siege of Paris; and convinced that a peaceful occupation of the throne was impossible without his professing the Catholic faith, he became nominally a Catholic in 1593. After his formal coronation in 1594 only three provinces held out against him—Burgundy, reduced by the victory of Fontaine-Française in 1595; Picardy, reduced by the capture of Amiens in 1596; and Brittany, which came into his hands by the submission of the Duke of Mercœur in the spring of 1598. The war against Spain was concluded in 1598 by the Peace of Vervins to the advantage of France. The same year was signalized by the granting of the edict of Nantes, which secured to the Protestants entire religious liberty. He made use of the tranquility which followed to restore the internal prosperity of his kingdom, and particularly the wasted finances, in which he was successful with the aid of his prime-minister Sully. At the instance of Sully Henry divorced Margaret of Valois, and in 1600 married Maria de' Medici, niece of the Grank-duke of Tuscany, mother of Louis XIII. She was crowned at St. Denis in 1610, but on the following day Henry was stabbed by a fanatic named Ravaillac, while examining the preparations for the queen's entry into Paris. The great benefits which Henry IV. bestowed upon France entitle him to the designation which he himself assumed at an assembly of the Notables at Rouen in 1596, the Regenator of France (Restaurateur de la France).

HENRY I., King of England, surnamed Beauclerc ("fine scholar") youngest son of William the Conqueror, was born at Selby in Yorkshire, in 1068. He was hunting with William Rufus when that prince was killed, in 1100, and instantly riding to London, caused himself to be proclaimed king, to the prejudice of his elder brother Robert, then absent as a crusader. Henry died at Rouen in 1135, and was succeeded by Stephen.

HENRY II., King of England, first of the Plantagenet line, born in Normandy in 1133, was son of Geoffrey, count of Anjou, and Matilda, daughter of Henry I. He was invested with the Duchy of Normandy, by the consent of his mother, in 1150; in 1151 he succeeded to Anjou and Maine, and by a marriage with Eleanor of Guienne gained Guienne and Poitou. In 1152 he invaded England, but a compromise was effected, by which Stephen was to retain the crown, and Henry to succeed at his death, which took place in 1154. He died at Chinon in 1189. He ranks among the greatest English kings both in soldiership and statescraft. He partitioned England into four judiciary districts, and appointed itinerant justices to make regular excursions through them; revived trial by jury, discouraged that by combat, and demolished all the newly elected castles as "dens of thieves."

HENRY III., King of England, son of John by Isabel of Angoulême; born at Winchester in 1207; succeeded his father in 1216. He died in 1272. His son Edward I. succeeded him.

Henry II., King of England. From his tomb.

HENRY IV., King of England, first king of the house of Lancaster; born in 1366; was eldest son of John of Gaunt, duke of Lancaster, third son of Henry III. by the heiress of Edmund, earl of Lancaster, second son of Henry III. In the reign of Richard II. he was made earl of Derby and Duke of Hereford, but having in 1398 preferred a charge of treason against Mowbray, duke of Norfolk, he was banished with his adversary. On the death of John of Gaunt in 1399 Richard withheld Henry's inheritance, and Henry, landing in England, gained possession of Richard's person. The deposition of Richard by parliament, and the election of Henry, was followed by the murder of the late king. Henry died in 1413, and was succeeded by Henry V.

HENRY V., King of England, born at Monmouth in 1388. On succeeding his father, Henry IV., in 1413, he showed a wisdom in marked contrast to a somewhat reckless youth. He restored their estates to the Percies, and liberated the earl of March, but in other respects based his internal administration upon that of his father. The persecution of the Lollards is the chief blot upon the early part of his reign. The struggle in France between the factions of the dukes of Orleans and Burgundy afforded Henry a tempting opportunity for revivin g the claims of his predecessors to the French crown. He returned in triumph to England, but on the defeat of his brother, the duke of Clarence, in Normandy by the earl of Buchan, he again set out for France, drove back the army of the dauphin, and entered Paris. A son was at this time born to him, and all his great projects seemed about to be realized, when he died of fever at Vincennes in August, 1422, at the age of thirty-four, and in the tenth year of his reign. He was succeeded by his son Henry VI.

HENRY VI., King of England, born at Windsor in 1421, was crowned at

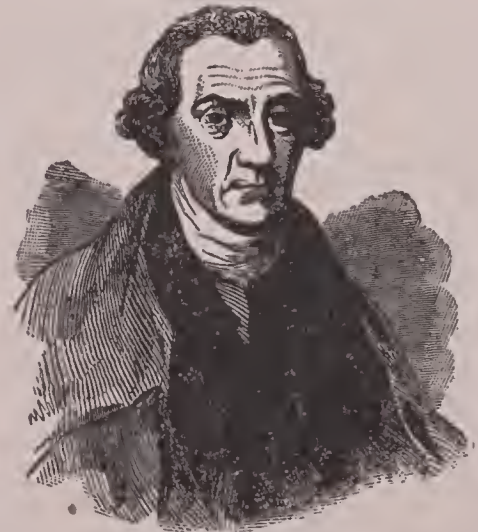
Westminster in 1429, at Paris in 1430. As he was an infant not nine months old at the death of his father Henry V., his uncle John, duke of Bedford, was appointed regent of France; and his uncle Humphrey, duke of Gloucester, made protector of the realm of England. He was a gentle, pious, well-intentioned, hopelessly incompetent king, whose best reputation is that of founder of Eton college and King's college, Cambridge.

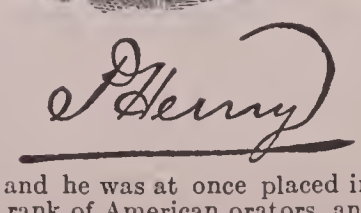
HENRY VII., King of England, first sovereign of the race of Tudor, born in 1456. He was the son of Edmund, earl of Richmond, son of Owen Tudor and Catherine of France, widow of Henry V. In 1486 he married Elizabeth, daughter of Edward IV. and heiress of the house of York, and thus united the claims of the rival houses of York and Lancaster. The reign of Henry VII. was troubled by repeated insurrections, of which the chief were that headed by Lord Lovel and the Staffords (1486), and the impostures of Lambert Simnel (1487) and Perkin Warbeck (1496-99). Henry died at Richmond in 1509.

HENRY VIII., King of England, son of the preceding, born in 1491, succeeded his father in 1509. From 1515 until 1529 the government was practically in the hands of Wolsey, no parliament being summoned in that period until 1523. After the election of Charles V. to the German Empire, both Charles and the French king, Francis I., sought the alliance of England. A friendly meeting took place between Henry and Francis at the Field of the Cloth of Gold (1520), but the interest of Charles preponderated, and Henry declared war against France, though with no important results. Now came the determination of the king to divorce his wife Catherine. Wolsey, for his own ends, had at first been active in promoting the divorce, but drew back and procrastinated when it became apparent that Anne Boleyn would be Catherine's successor. This delay cost Wolsey his power and the papacy its authority in England. Henry in disgust eagerly caught at the advice of Thomas Cranmer, afterward Archbishop of Canterbury, to refer the case to the universities, from which he soon got the decision that he desired. In 1533 his marriage with Catherine was declared null and an anticipatory private marriage with Anne Boleyn declared lawful; and as these decisions were not recognized by the pope, two acts of parliament were obtained, one in 1534 setting aside the authority of the chief pontiff in England, the other in 1535 declaring Henry the supreme head of the church. Finding that the monks and friars in England were the most direct advocates of the papal authority, and a constant source of disaffection, he suppressed the monasteries by act of parliament, and thereby inflicted an incurable wound upon the Catholic religion in England. The fall of Anne Boleyn was, however, unfavorable for a time to the reformers. Henry then married Jane Seymour, and the birth of Prince Edward in 1537 fulfilled his wish for a male heir The death of the queen was followed in 1540 by Henry's marriage with Anne of Cleves, the negotiations of which were conducted by Cromwell. The king's dislike to his wife, which resulted in another divorce, became extended to the minister who had proposed the union, and Cromwell's disgrace and death soon followed. A marriage with Catherine Howard in 1541 proved no happier, and in 1542 she was executed on a charge of infidelity. In 1543 he married his sixth wife, Catherine Parr, a lady secretly inclined to the Reformation, who survived the king. In the meantime Scotland and France had renewed their alliance, and England became again involved in war. James V. ravaged the borders, but was defeated at Solway Moss in 1542, and in 1544 Boulogne was captured, Henry having again allied himself with Charles V. Charles, however, soon withdrew, and Henry maintained the war alone until 1546. Disease now so much aggravated the natural violence of Henry that his oldest friends fell victims to his tyranny. The duke of Norfolk was committed to the Tower, and his son the earl of Surrey was executed. Henry died on Jan. 28, 1547, and was succeeded by his son, Edward VI.

HENRY, Joseph, American physicist, was born at Albany, N. Y., in 1799. He was a great experimenter and did much toward the development of the science of electricity. In 1831 he sent a current through a mile of copper wire and caused the armature of the electro magnet to be attracted and strike a bell which was the first electro-magnet telegraph and he is to be regarded as the inventor of the principle now applied in modern practice. In 1846 he was chosen secretary of the Smithsonian Institution, a position that he held until his death in 1878.

HENRY, Patrick, American orator and patriot, was born in Hanover co., Va., in 1736. In 1764 having been employed to plead the cause of the people against an unpopular tax, his great eloquence seemed suddenly to develop





itself and he was at once placed in the front rank of American orators, and his later speeches advanced him to their head. From amid the sullen murmurs and remonstrances that the passage of the stamp act evoked, his voice it was that first rose in a clear, bold call to resistance. A storm of opposition followed his resolutions, setting forth that the governor had the exclusive right to lay taxes and imports upon the people of the colony. In the debate he startled all by his historic outburst "Caesar had his Brutus, Charles the First his Cromwell, and George the Third—" (here he was interrupted with cries of treason! treason!) "may profit by their example," calmly said the orator, completing the sentence, adding, "If this be treason make the most of it." Throughout the war of independence he was a zealous patriot. He was a delegate to the first Continental congress, which met at Philadelphia in 1774, and delivered the first speech in that assembly—a speech that for fiery eloquence and lofty tone was worthy of so momentous a meeting. In 1776 he carried the vote of the Virginia convention for independence; and in the same year he became governor of the new state. He was afterward four times re-elected. In 1791 he retired from public life, and returned to his practice; in 1795 he declined the secretaryship of state offered him by Washington. Henry was an able administrator, a wise and far-seeing legislator; but it is as their greatest orator that his memory lives in the minds of Americans. He died in 1799.

HENRY THE LION, Duke of Saxony, the most remarkable prince of Germany in the 12th century, was born in 1129. He succeeded his father, Henry the Proud, in 1139, assuming the government of Saxony himself in 1146. At the diet of princes in Frankfort (1147) he demanded restitution of Bavaria, taken from his father by Conrad VII.; but was worsted in the war which followed. It was restored to him, however, in 1154, after the death of Conrad, by the Emperor Frederick, Henry's cousin. His possessions then extended from the Baltic and the North Sea to the Adriatic, and he was successful in opposing the league formed against him at Merseburg in 1166. Henry died at Brunswick 1195. He was much in advance of his age in fostering industry, science, commerce, and the arts.

HENRY THE NAVIGATOR, fourth son of King John I. of Portugal, born in 1394. From time to time he sent vessels on voyages to the coasts of Barbary and Guinea; resulting in the discovery of the islands of Puerto Santo and Madeira and some years later of the Azores. In 1433 Gilianez, one of his navigators safely doubled Cape Bojador, and other adventurers, pushing still further south discovered Cape Blanco in 1441 and Cape Verd in 1445. A profitable commerce with the natives of West Africa was soon developed, and the Senega and Gambia partially explored. After acting as general against the Moors in 1458 Henry died at Sagres on the 13th of November, 1458. His efforts not only laid the foundations of the commerce and colonial possessions of Portugal but gave a new direction to navigation and commerical enterprise.

HEN'SON, Josiah, American clergyman and lecturer, born a slave in Por-

Tobacco, Md., in 1787. His early career is remarkable for the hardships he was forced to endure. He escaped into Canada in 1828, and became a Methodist preacher at Dresden. Mrs. Harriet Beecher Stowe met him, and drew from the story of his life her character of Uncle Tom. Henson lectured throughout the United States, and made three trips to England during the last years of his life. While upon his final tour in 1876 he was entertained at Windsor Castle by Queen Victoria. He died in 1883.

HEPHÆS'TUS, a god of the ancient Greeks, identified by the Romans with their Vulcanus. He presided over fire, and was the patron of all artists who worked in iron and metals.

HEP'TATEUCH, a name sometimes given to the five books of Moses or Pentateuch, together with the books of Joshua and Judges.

HERA, an ancient Greek goddess, identified by the Romans with their Juno, the sister and wife of Zeus (Jupiter), and daughter of Kronos (Saturn, and Rhea. The poets represent Zeus as an unfaithful husband, and Hera as an

Hera.—Antique statue.

obstinate and jealous wife, the result of which is frequent strife between them. She was worshiped in all Greece, but her principal seats were at Argos and at Samos. The companions af Hera were the Nymphs, Graces, and Hours. Iris was her particular servant.

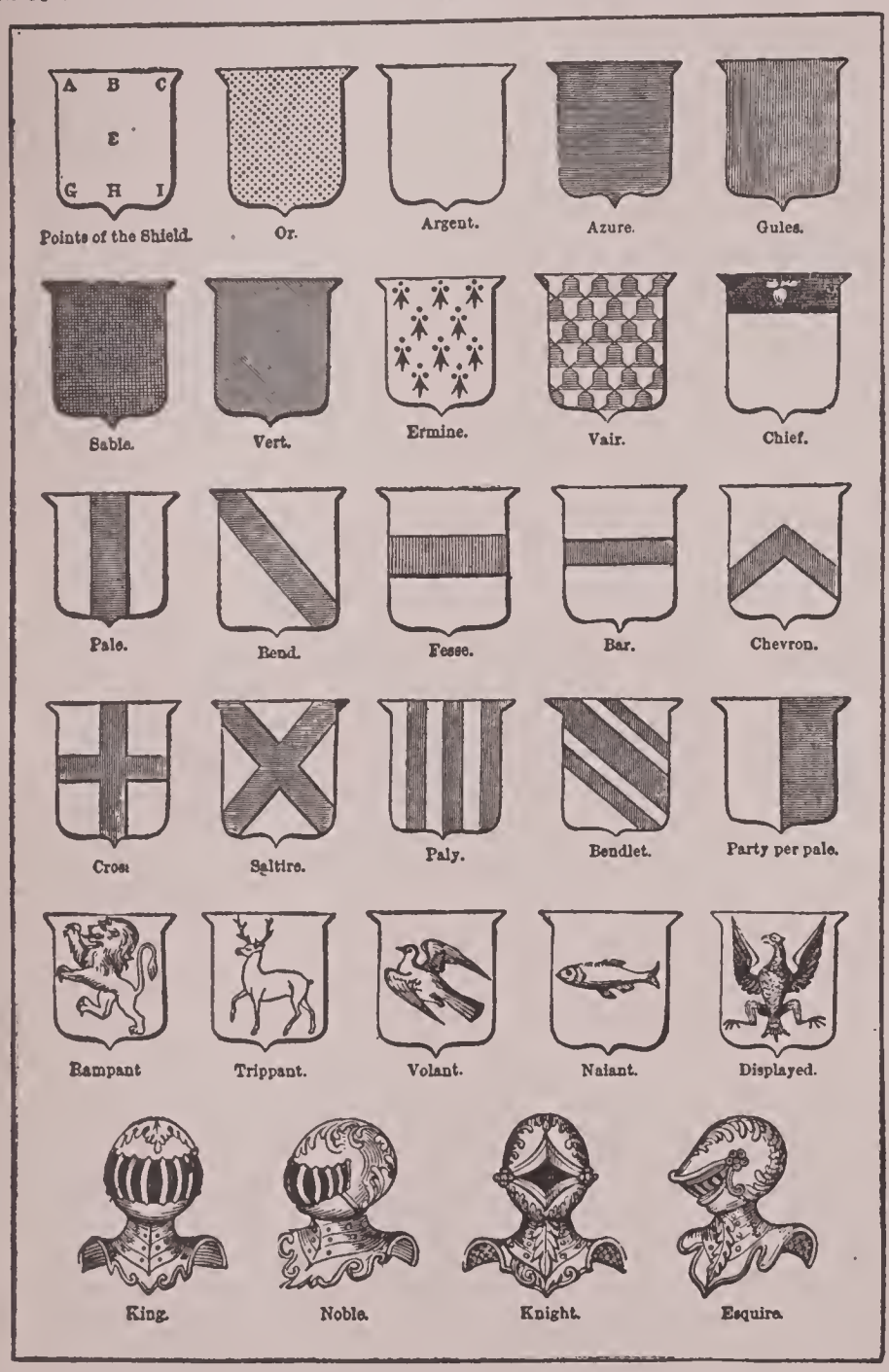
HER'ACLES, called by the Romans Hercules, the most celebrated hero or semi-divine personage of Greek mythology, was the son of Zeus (Jupiter) by Alcmena, the wife of Amphitryon. He was brought up at Thebes, and before he had completed his eighth month strangled two snakes sent by the jealous Hera (Juno) to devour him. In youth he had several distinguished instructors, among them the Centaur Cherion. Early in life he had, at the command of Zeus, to subject himself for twelve years to the will of Eurystheus, on the understanding that after he had acquitted himself of this duty he should be reckoned in the number of the gods. He became the husband of Dejanira, who unwittingly brought about his death by giving him a tunic poisoned with the blood of the Centaur Nessus, which she innocently believed would retain for her Heracles love. The poison took effect whenever the garment was put on, and as the distemper was incurable, Hercales placed himself on a burning pile on the top of Mount Œta, was received up into heaven, and being there reconciled to Hera, received her daughter Hebe in marriage. In ancient works of art Hercales is generally represented naked, with strong and well proportioned limbs; he is sometimes covered with the skin of the Nemæan lion, and holds a knotted club in his hand, on which he often leans. The principal ancient statue of him which remains is the Farnese Hercules at Rome, a work of the Athenian Glycon. The myth of Hercules is believed by many writers to represent the course of the sun through the twelve signs of the zodiac. His marriage with Hebe was explained even by the ancients as symbolic of the renewing of the sun's course after its completion.

HERACLI'US, Roman emperor of the East, born in Cappadocia about 575 A.D.; the son of Heraclius, exarch of Africa. He died in 641, and was succeeded by his son, Constantine III.

HER'ALD, an officer whose functions originally were to carry messages of courtesy or defiance between sovereigns or persons of knightly rank, to superintend and register the results of trial by battle, tournaments, and other chivalric exercises, to record the valiant deeds of combatants, proclaim war or peace, marshal processions and public ceremonials, and especially, in later times, to regulate and determine all matters connected with the use of armorial bearings. Heralds began to appear about the 12th century, and assumed the functions which ultimately belonged to their office gradually.

HER'ALDRY, the whole science of a herald's duties, or more commonly the knowledge of the forms, terms, and laws which pertain to the use of armorial bearings or coats of arms. Badges and emblems on shields, helms, banners, etc., naturally occurred in the earliest times, and the symbols were sometimes hereditary. The origin of heraldic arms, properly so called, is, however, to be attributed to the necessity which arose during the crusades of distinguishing the leaders of the numerous and motly bands of warriors which constituted the Christian armies. One of the oldest specimens of heraldic bearings extant is the shield at Mans of Geoffrey Plantagenet, who died in 1150. Rolls of arms in England are extant from the reigns of Henry III., Edward I., and Edward II. The use of arms on the Great Seal of England was introduced by Richard I. The bearing of coat-armor by private persons was prohibited by proclamation in the reign of Henry V. The chief courts of jurisdiction in questions of heraldry are the Herald's college in England, and the Lyon court in Scotland. (See Herald.) The rules of heraldry now practiced at the Heralds' college are comparatively modern, and differ in some respects from those of other European courts. A coat of arms consists of the figure of a shield marked and colored in a vast variety of ways, so as to be distinctive of an individual, a family, or a community. The shield or escutcheon represents the original shield used in war, and on which arms were anciently borne. The surface of the escutcheon is termed the field, and the several parts or points of it have particular names, so that the figures which the field contains may be precisely located. In the accompanying illustration A B C marks the part of the shield called the chief, which is the highest and most honorable part of the shield. A is the dexter chief or upper right-hand side of the shield; B, the middle chief; and C, the sinister chief, or upper left-hand side of the shield; E, the center or fesse point; G H I, the base, that is, G, the dexter or right-hand base; H, the middle base; and I, the sinister of left-hand base. Color is given in the coat of arms by means of tinctures, two of which are metals—or and argent, that is, gold and silver—the rest colors proper. These colors are, in heraldic terminology: azure, blue; gules, red; sable, black; vert, green; purpure, purple; tenney, orange; sanguine, blood-color. The two last are comparatively uncommon. An object represented in its natural colors is said to be proper. When not given in colors or by actual gilding the tinctures are represented by points and lines in black and white. Or is distinguished by small dots covering the part; argent is represented by leaving the space blank; azure is shown by horizontal lines; gules, by perpendicular lines; sable, by perpendicular and horizontal lines crossing each other; vert, by diagonal lines running from the dexter chief to the sinister base; purpure by diagonal lines running from the sinister chief to the dexter base. Another class of tinctures are the furs, of which the two principal are ermine and vair, and which have also their special method of representation. The figures borne on the shield may be either purely artificial and conventional, or may represent real objects, animals, plants, etc. Of the former the most common are known as ordinaries, and have the folfowing names: Chief, Pale, Bend, Fesse, Bar, Chevron, Cross, and Saltire. The chief is a portion of the shield at the top marked off by a horizontal line, and covers the upper third part of the field. The pale occupies the middle third part of the field perpendicularly. The bend is drawn diagonally from the dexter chief to the sinister base in the form of a belt, and also occupies the third of the field. A dimunutive of the bend is the bendlet. The fesse occupies the middle third of the field horizontally. The bar is formed after the manner of a fesse, but occupies only a fifth of the field, and is not confined to any particular part of it, except when there is only one bar, when it is put in the place of a fesse. Bars are mostly two in a field, sometimes three or more. A diminutive is the barrulet. The chevron may be regarded as made of a bend dexter and sinister issuing from the right and left base points of the escutcheon and meeting like two rafters. The cross is the ordinary cross of St. George. The saltire is the equally well-known cross of St. Andrew. The shield is often divided by lines running similarly to the ordinaries; hence when divided by a perpendicular line it is said to be party per pale, when by a horizontal

line party per fesse, when by a diagonal line party per bend. Similarly, when it seems to bear several pales or bends or bars, it is said to be paly, bendy, or barry of so many pieces, "paly of six argent and gules" for instance, as in illustration. Charges are the figures of natural and artificial things, and include animals and plants, implements and objects of all sorts, and various imaginary monsters, being drawn either on the field or on one of the ordinaries. It is a rule in heraldry that metal must not be put on metal nor color on color; hence, if the field say is argent, it cannot have a charge or an ordinary tinctured or directly upon it. Various technical terms describe the position of animals; thus, a lion is rampant when he is erect standing on one of his hind legs; sejant, when sitting; couchant, when lying at rest, with the head erect; passant, in a walking position; gardant, looking full-faced; rampant gardant, erect and full-faced; salient, in a leaping posture. So trippant is said of the stag when trotting; lodged, of the stag when at rest on the ground; volant, of birds in general in a flying posture; rising, of a bird that is preparing to fly; displayed, of birds seen frontwise with outspread wings; naiant, of fishes when swimming; and so on. The teeth and claws of lions and other ravenous beasts are called their arms; and when these have a special tincture the animal is said to be armed of such a tincture; similarly if their tongue be of a special tincture, they are said to be be languaged of this tincture. Often two or more coats of arms are united together on one shield, so that the whole may be a very complicated affair. The art of arranging arms in this way is known as marshalling, and when the shield is divided up into squares for the reception of different coats, it is said to be quartered. There are also certain exterior ornaments of the shield or escutcheon, namely, the helmet, mantling, crest, wreath, motto, and supporters. The helmet, which is placed on the top of the escutcheon, varies both in form and materials. Those of sovereign princes are of gold, those of the nobility of silver, and those of gentlemen of polished steel. The full-faced helmet, with six bars, is for the king and princes of the blood; the side-long helmet, with five bars, is for dukes and marquises, etc.; the full-faced helmet of steel, with its beaver or visor open, is for knights; and the sidelong helmet, with the visor shut, for the esquire. The mantling or mantle was anciently fixed to the helmet to which it served as a covering. Mantlings are now used like cloaks, to cover the whole achievement. The crest is placed above the helmet, with the wreath serving as a kind of support; the latter is composed of two colors wreathed or twisted together. The motto consists of the word or phrase carried in a scroll under or above the arms. Supporters were originally only ancient devices or badges, which by custom came to embellish armorial ensigns. They are called supporters because they hold the shield, as the lion and the unicorn in the well-known royal arms of England. The present royal arms of Britain exhibit the arms of England, Scotland, and Ireland in the four quarters of the shiefd; that is: Quarterly, 1 and 4, England; 2, Scotland; 3, Ireland. The arms of England are: Gules, three lions passant gardant in pale or; Scotland, Or, a lion rampant within a double tressure flory counter-flory gules; Ireland, Azure, a harp or, stringed argent.



HERAT', a city in the northwest of Afghanistan, about 370 miles west of Cabul. The most important manufactures are carpets, sword-blades, shoes, cloaks, and sheepskin caps. Herat was long the capital of the empire founded by Tamerlane. Pop. about 45,000.

HERAULT (ā-rō), a department of France, on the Mediterranean coast; area, 2393 sq. miles. In the northwest it is covered by the Cevennes, but it descends rapidly towards the coast, which is lined by lagoons. Capital Montpellier. Pop. 441,527.

HERCULA'NEUM, an ancient city about 5 miles s.e. from Naples, completely buried with Pompeii, Stabiæ, etc., by lava and ashes during an eruption of Vesuvius in the reign of Titus, A.D. 79. The site had been long sought in vain, when in 1713 three statues were found in digging a well at the village of Portici. In 1738 the well was dug deeper, and traces of buildings were found. The theater was then discovered, but though the excavations were continued for many years it is now the only building to be seen underground, as the successive excavations were immediately filled up with rubbish from a new digging. A number of public buildings and private dwellings were laid bare, and many objects of great value discovered, such as statues, busts, beautiful mosaics, wall paintings, charred papyrus manuscripts, etc. One of the houses discovered contained a quantity of provisions, consisting of fruits, corn, oil, pease, lentils, pics, and hams. Few

skeletons have been found either in Pompeii or Herculaneum, so that it is probable most of the inhabitants had time to save themselves by flight. Among the most interesting objects discovered here were the papyri, over 1750 of which are now in the Naples Museum but hardly a third have yet been unrolled, the process presenting great difficulties from the tendency of the MSS. to crumble. The knowledge of ancient art has, however, gained more by the discoveries made here than literature.

HERCULES. See Heracles.

HERCULES, one of Ptolemy's northern constellations, including 113 stars. The point to which the sun, with its

Hercules slaying the hydra.—From sculpture at Florence.

accompanying system of planets, is traveling at present is situated in this constellation, which includes some remarkable star groups and nebulæ.

HERCULES, Pillars of, the ancient name of the two promontories, Calpe (Gibralter) and Abyla (Ceuta), at the entrance to the Mediterranean.

HERDER, Johann Gottfried von, German author, born in poor circumstances in 1744. His greatest work is his Ideen zur Philosophie der Geschichte der Menschheit (Ideas on the Philosophy of the History of Man; 1785 et seq.). He is the author of some pleasing songs, and of an epic entitled The Cid. He died in 1803.

HEREDITARY DISEASES. See Diseases.

HERED'ITY, the transmission from parent to offspring of physical and intellectual characters. This has been at all times believed in, but it is only in recent times that the conviction has, in the hands of Darwin, Herbert Spencer, and Wallace, been methodized so as to embody an important zoological doctrine. The modern view of evolution in biology rests upon the belief that acquired peculiarities, or differences which may arise between parent and offspring, can be transmitted with some probability of permanence, especially if the variation presented by the young is determined by external conditions, or if it is such as to adapt the possessor more thoroughly to the conditions under which it is placed. On the other hand, while variations may be thus permanently transmitted by heredity, yet this very tendency of the young to repeat the characters of the parent is also a check on variability, or the tendency of structure and attributes to change with the environment. It may be noted that while the strong tendency to hereditary transmission works in the majority of cases so as to perpetuate those most fitted to survive, it secures the same result in other cases by a converse action. The descent of disease in families tends ultimately to purify the race by accumulating incapacities which end in the extinction of the enfeebled strain.

HEREFORD (he're-ford), a city and parliamentary borough of England, capital of county of same name, on the left bank of the Wye. Pop. 21,382.—The county, which is entirely inland, and borders on Wales, has an area of 532,898 acres, of which about 500,000 are arable, meadow, and pasture. Wheat is the principal crop, but barley, oats, beans, pease, hops, and turnips are also extensively cultivated. Orchards are numerous, and a large quantity of excellent cider is made. Pop. 114,401.

HERETIC, one who embraces a heresy, that is, one who holds some theological doctrine which conflicts with the beliefs of the Catholic or universal church, but who, at the same time, calls himself a Christian. As early as 385 Priscillian was condemned to death as a heretic by the Spanish bishops at the council of Trèves; but the persecutions of heretics, properly so called, began in the pontificate of Gregory VII., in the 11th century. Spain, Italy, and France, from the 13th century, suffered much from these persecutions, but the states of Germany showed greater moderation. In England the burning of heretics was practiced before 1200, and long continued. Heresy is now left entirely to the cognizance of the ecclesiastical courts.

HERMAPH'RODITE, an animal in which the characteristics of both sexes are either really or apparently combined, especially an animal having the parts of generation both of male and female, so that reproduction can take place without the union of two individuals. Hermaphrodites are divided into true and spurious, the first exhibiting a real combination of the characteristic of the two sexes; while in the second the combination is only apparent. The animals in which the organs of the two sexes are normally combined in the same individual are confined to the invertebrate division of the animal kingdom, as for example certain groups of the inferior worms, molluscs, barnacles, etc. There are no real hermaphrodites in the human species.

HERMES, called by the Romans Mercurius, in Greek mythology the son of Zeus and Maia, the daughter of Atlas. He was born in Arcadia, and soon after his birth left his cradle and invented the lyre by stringing the shell of a tortoise with three or seven strings. The lyre, however, he resigned to Apollo, with whom it was ever after identified. Hermēs also invented the Pandean pipe. The ancients represent Hermēs as the herald and messengers of the gods. He conducted the souls of the departed to the lower world. He was the ideal embodiment of grace, dignity, and persuasiveness, but also of prudence, cunning, fraud, perjury, theft, and robbery. His cunning was frequently of service both to the gods and the heroes, and even to Zeus himself. Later writers ascribe to him the invention of dice, music, geometry, letters, etc. He was worshiped in all the cities of Greece, but Arcadia was the chief place of his worship, his festivals being called Hermæa. In the monuments he is rep-

Hermes.—Wall painting, Pompeii.

resented as in the flower of youth, or in the full power of early manhood. He often appears with small wings attached to his head and to his ankles. Among his symbols are the cock, the tortoise, a purse, etc., and especially his winged rod, the caduceus.

HERMES TRISMEGIS'TUS, a mythical personage, the reputed author of a great variety of works, probably written by Egyptian Neo-Platonists, who ascribed the authorship of the highest attainments of the human mind to Thoth, the Egyptian Hermes; regarding him as the source of all knowledge and inventions, the Logos incarnate, thrice greatest (Gr. tris megistos).

HERMETIC SEALING, the term used to denote a very old process in which a glass vessel, such as a tube or flask, has its neck so fused together that no part of the contained matter can escape, and nothing foreign can get in.

HERMIT-CRAB, a name common to a family of well-known decapod crustaceans. These crabs take possession of and occupy the cast-off univalve shells of various molluscs, carrying this habitation about with them, and changing it for a larger one as they increase in size.

HERMON, a mountain of Syria, belonging to the Anti-Lebanon, about 9400 feet high.

HERNANDIA, a genus of large East Indian trees. They have alternate entire leaves and flowers arranged in axillary or terminal spikes or corymbs. H. Sonora, or Jack-in-the-box, is so called from the noise made by the wind whistling through its persistent involucels. The fibrous roots chewed and applied to wounds caused by the Macassar poison form an effectual cure, and the juice of the leaves is a powerful depilatory.

HERNIA, in surgery, a tumor formed by the displacement of a soft part, which protrudes by a natural or accidental opening from the cavity in which it is contained. The brain, the heart, the lungs, and most of the abdominal viscera may become totally or partially displaced, and thus give rise to the formation of hernial tumors. But the term is ordinarily applied to abdominal hernia.

Every part of the abdomen may become the seat of hernia, but it most commonly appears in the anterior and inferior region, which, being destitute in a great measure of muscular fibers, and containing the natural openings, offers less resistance to the displacement of the viscera. Most of the viscera, when displaced, push the peritoneum forward

Hernandia Sonora (Jack-in-the-box).

before them: this membrane thus formed an envelope of the hernia, which is called the hernial sac. The hernia itself is usually a loop of the small bowel, and though it has been pushed through the wall of the abdomen, forming a tumor under the skin, the fæces still pass along it. If the hernia can be returned to the abdomen, it is said to be reducible; if, from its size or other cause, it cannot be replaced, it is irreducible. A hernia is said to be strangulated when it is not only irreducible, but also subjected to a continual constriction, which interferes with the circulation through the blood-vessels of the part and the passage of the fæces. It may be rapidly fatal. Constriction may be produced by different causes, but generally occurs at the margins of the opening through which the hernia protrudes. As soon as a patient perceives that he is affected with a hernia he should have recourse to medical advice, for the disease is then in its most favorable state for treatment. The hernia when it is reduced must be prevented from recurring by the constant pressure of a pad or truss. An irreducible hernia must be supported with great care. All violent exercises, and excess in diet, must be avoided. The strangulated hernia requires prompt relief, and may necessitate an operation.

HERO, a Greek priestess of Aphroditē at Sestos, on the coast of Thrace, for love of whom Leander, a youth of Abydos, swam every night across the Hellespont, guided by a torch from her tower. He was at length drowned in the attempt and his body washed ashore, when Hero, overcome with anguish, threw herself from the tower on the corpse of her lover, and perished. There is a Greek poem by Musæus on this subject.

HER'OD, called the Great, King of the Jews, was a native of Ascalon, in Judea, where he was born about 74 B.C. The birth of Jesus Christ is said to have taken place in the last year of the reign of Herod, viz. B.C. 4, the year also signalized by the massacre of the children of Bethlehem. Herod's policy and influence gave a great temporary splendor to the Jewish nation, but he was also the first to shake the foundation of the Jewish government, by dissolving the national council, and appointing the high-priests and removing them at pleasure, without regard to the laws of succession.

HEROD AGRIPPA I., son of Aristobulus by Bernice, daughter of Herod the Great. From his attachment to Caligula he was imprisoned by Tiberius, but on the accession of Caligula (A.D. 37) he received the government of part of Palestine, and latterly all the dominions of Herod the Great. To please the Jews, with whom his rule was very popular, he caused St. James to be put to death, and imprisoned St. Peter. He died in the circumstances related in Acts xii., in A.D. 44.

HEROD AGRIPPA II., son of the preceding, and last of the Herodian line. He is supposed to have died in Rome, A.D. 94.

HEROD AN'TIPAS, son of Herod the Great by his fifth wife, Cleopatra, was appointed tetrarch of Galilee on his death (B.C. 4). This was the Herod who put to death St. John the Baptist, in compliment to his wife Herodias in revenge for his reproaches of their incestuous union. Having visited Rome he was accused of having been concerned in the conspiracy of Sejanus, and was stripped of his dominions, and sent (A.D. 39) with his wife into exile at Lugdunum (Lyons), or, as some say, to Spain, where he died.

HEROD'OTUS, the oldest Greek historian whose works have come down to us, the "father of history," born at Halicarnassus in Asia Minor about B.C. 484. Before writing his history he traveled extensively, visiting the shores of the Hellespont and the Euxine, Scythia, Syria, Palestine, Babylon and Ecbatana, Egypt as far as Elephantine and other parts of northern Africa, everywhere investigating the manners, customs, and religion of the people, the history of the country, productions of the soil, etc. On returning home he found that Lygdamis had usurped the supreme authority in Halicarnassus, and put to death the noblest citizens, among others his uncle, the epic poet Panyasis, and Herodotus was forced to seek an asylum in the island of Samos. Having formed a conspiracy with several exiles he returned to Halicarnassus and drove out the usurper, but the nobles who had acted with him immediately formed an aristocracy more oppressive than the government of the banished tyrant, and Herodotus withdrew to the recently founded colony of Thurii, in Italy, where he seems to have spent most of his remaining life. Here, at an advanced age, we are told by Pliny, he wrote his immortal work, a statement strengthened by the fact that events are noticed in the body of the book which occurred so late as 409 B.C., while its abrupt ending proves almost beyond question that he was prevented by death from completing it. The history is divided into nine books, each bearing the name of a muse, and is written in the Ionic dialect.

HEROES, a name applied by the Greeks to mythical personages who formed an intermediate link between men and gods. There were six great heroic races, descended respectively from Prometheus and Deucalion, Inachus, Agenor, Danaus, Pelops or Tantalus, and Cecrops. Individual families as, for instance, the Æacidæ, Atridæ, Heraclidæ, belong to one or another of these races.

HERON, the name common of birds constituting with the bitterns type of what is now commonly regarded as a separate order of birds, the Herodiones. The herons are very numerous, and al-

Common heron.

most universally spread over the globe. They are distinguished by having a long bill cleft beneath the eyes, a compressed body, long slender legs naked above the tarsal joint, three toes in front, the two outer united by a membrane, and by moderate wings. The tail is short, rounded, and composed of ten or twelve feathers. The common heron is about 3 feet in length from the point of the bill to the end of the tail, builds its nest in high trees, many being sometimes on one tree.

HERRICK, Robert, an English poet, born in London, 1591, died in Oct., 1674. His compositions were published in 1648, under the title of Hesperides, or the Works, both Humane and Divine, of Robert Herrick. It is a delightful collection of love lyrics, epigrams, sketches of rural scenery, etc.

HERRING, the general name of the common herring. It is of wide distribution in the North Atlantic, 45° n. lat. being about the southern limit. It measures from 10 to 12 inches in length, with blue-green back and brilliant silvery white under parts. It has small teeth in both jaws, and is of an elegant shape, the body being much compressed. It was formerly supposed that the herrings migrated in two great shoals every summer from the Polar Seas to the coasts of Britain and France, returning in the winter, but the migration is probably only from a deeper part of the ocean to a shallower. The feeding ground of the herring is probably the mud deposits found in the deeper parts of the sea, and it seems to be a fact that during their visits to the shallower waters of the coast for the purpose of spawning they do not feed, or feed very little. In summer the herring leaves the deep water where it has passed the winter and spring months, and seeks the coast where it may deposit its ova, and where they may be exposed to the influence of oxygen, heat, and sun-light, which are essential to their development. They are generally followed by multitudes of hakes, dog-fishes, etc., and gulls and other sea-birds hover over the shoals. They swim near the surface, and are therefore easily taken by net. So great is their fecundity that the enormous number taken appears to produce no

diminution of their abundance, as many as 68,000 eggs having been counted in the roe of one female.

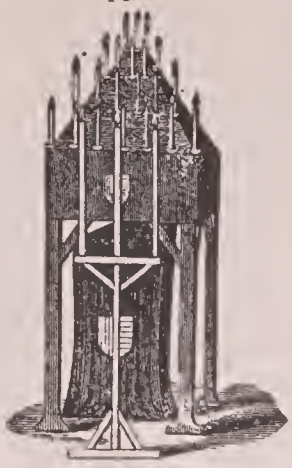
HERSCHEL, Sir John Frederick William, only son of Sir William Herschel, was born in 1792 at Slough, near Windsor, died in 1871. In 1834 he established at his own expense, an observatory at Feldhuysen, near Cape Town, his object being to discover whether the distribution of the stars in the southern hemisphere correspond with the results of his father's labors in the north. He returned to England in 1838, and in 1847 was published Results of Astronomical Observations made during 1834–38 at the Cape of Good Hope, being the Completion of a Telescopic Survey of the Whole Surface of the Visible Heavens.

HERSCHEL, Sir William, astronomer, son of a musician of Hanover, born 1738, died 1822. He came to England in 1757, and was employed in the formation of a military band, and in conduct-

Sir William Herschel.

ing, while organist at Bath, several concerts, oratorios, etc. Although enthusiastically fond of music, he had for some time devoted his leisure hours to the study of mathematics and astronomy; and being dissatisfied with the only telescopes within his reach, he set about constructing instruments for himself. Late in 1779 he began a regular survey of the heavens, star by star, with a 7-foot reflector, and discovered, March 13, 1781, a new primary planet, named by him the Georgium Sidus, but now known as Urănus. This discovery extended his fame throughout the world, and brought him a pension of $2,000 a year, with the title of private astronomer to the king. Assiduously continuing his observations, he measured the rotation of Saturn, discovered two of his satellites, and observed the phenomena of its rings. He also discovered the satellites of Uranus, and observed the volcanic structure of the lunar mountains. At Slough, near Windsor, he erected a telescope of 40 feet length, and completed it in 1787. Herschel received much assistance in making and recording observations from his sister Caroline; and latterly his brother, a skilful optical instrument maker, lent him valuable aid. In 1802 he laid before the Royal Society a catalogue of 5000 nebulæ and clusters of stars which he had discovered. He was made D.C.L. by the University of Oxford, and in 1816 was knighted.

HERSE, Hearse, a framework whereon lighted candles were placed at the obsequies of distinguished persons. The funeral herse of the middle ages was a temporary canopy covered with wax-



Herse.—MS. in Bodleian library.

lights, and set up in the church; the coffin was placed under the herse during the funeral ceremonies. Sometimes it was a very elaborate structure. The name has been transferred to the modern carriage for bearing a dead body to the grave.

HERTFORD, town and former parl. borough of England, capital of the county of same name, on the Lea, 19 miles north of London. Pop. 9322.—The county of Hertford is bounded by Cambridgeshire, Essex, Middlesex, Buckingham, and Bedford; area, 405,141 acres, of which about five-sixths are arable, meadow, and pasture. The general aspect of the county is pleasing, being diversified by hill and valley, pasture lands, arable farms, and picturesque parks and woods. The principal rivers are the Lea and Colne, both of which have numerous tributaries. Agriculture employs a large number of the inhabitants. Pop. 250,350.

HERZEGOVINA (hert-se-go-vē′nȧ), a province of the Balkan peninsula, now under the Austrian sway, bounded on the n. by Croatia and Bosnia, on the e. by Novibazar, on the s.e. by Montenegro, and on the s. and w. by Dalmatia; area, 700 sq. miles. The surface is generally mountainous, but contains many fertile valleys. Pop. about 220,000.

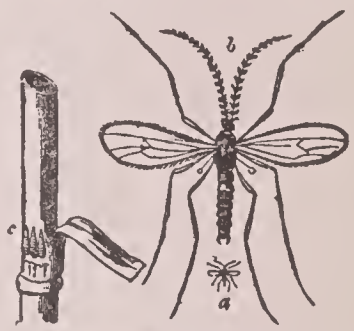
HESPER′IDES (-dēz), in Greek mythology, certain nymphs who lived in gardens, of rather uncertain locality, as guardians of the golden apples that grew there, being assisted in the charge by a dragon.

HES′PERUS, among the ancient Greeks, a name of the evening star (the planet Venus).

HESSE, or **HESSEN,** Grand-duchy of, formerly known as Hessen-Darmstadt, an independent state of South Germany, consisting of sundry distinct portions. Area of whole grand-duchy, 2964 sq. miles. About two-thirds of the inhabitants are protestants. Pop. 1,119,893.

HESSE-NASSAU, or **HESSEN-NASSAU,** a province of Prussia, formed out of the former Principality of Hesse-Cassel, the Duchy of Nassau, the Landgraviate of Hesse-Homburg, the territory and town of Frankfort, etc. It borders on the Prussian provinces of Westphalia, Hanover, Saxony, and the Rhineland, the Kingdom of Bavaria, etc., and incloses Upper Hesse. The boundary is partly formed by the Rhine, Main, Weser, and Werra. Other rivers are the Lahn and Eulda. The greater part of this province belongs to the central German plateau, and has a rugged surface, partly covered by branches of the Harz. Still, about 40 per cent of the whole is arable, while about the same is under wood. The chief mineral is iron. Mineral springs are numerous. The manufactures consist chiefly of woolens, cottons, and linen. The principal towns are Cassell, the capital, Wiesbaden, and Frankfort. Pop. 1,897,981.

HESSIAN FLY, a fly, the larva of which is very destructive to wheat, barley, and rye crops (it does not attack oats). It is so named from the unfounded belief, prevalent in America, where it is specially destructive, that it was brought over to that country in the baggage of the Hessian mercenaries employed against the Americans in the war of independence. The female fly is about the eighth of an inch in length,



Hessian-fly.
a, Male (natural size). *b*, Male (magnified) *c*, Pupæ fixed on the joint of the wheat-stalk.

with a wing expanse of about a quarter of an inch. Its body is brown, with the upper parts, the thorax, and the head of a darker shade, approaching to black. The wings are of a dusky gray, and are surrounded with fringes. The male is somewhat smaller than the female and has longer antennæ. The female flies usually lay their eggs on the young plants twice in the year, in May and September, out of which eggs the maggots hatch in from four to fourteen days. These work themselves in between the leaf-sheath and the steam, and fix themselves near the lowest joints, often near the root, and suck the juices of the stem, so that the ear falls down at a sharp angle. These maggots turn to pupæ, from which the flies develop in about ten days.

HETMAN, or **ATAMAN,** the title of the head (general) of the Cossacks. This dignity was abolished among the Cossacks of the Ukraine by Catharine the Great, and although the Cossacks of the Don still retain their hetman, the former freedom of election is gone, and the title of chief hetman is now held by the Russian heir-apparent to the crown.

HEWITT (hū′ĭt), Abram Stevens, American manufacturer and politician, was born in 1822 at Haverstraw, N. Y. He studied law and was admitted to the bar in 1844. He served in congress in 1871–79 and 1881–86, and was chairman of the national democratic com-

mittee which directed the Tilden campaign in 1876. In 1886 he was elected mayor of New York City, defeating Henry George and Theodore Roosevelt. He was chosen chairman of the trustees of the Carnegie institution at its organization in 1901. He died in 1903.

HEXAM'ETER, a verse of six feet, the heroic or epic measure of the Greeks and Romans. The sixth foot is always a spondee (two long syllables) or a trochee (a long and a short). The five first may be all dactyls (two short syllables and one long), or all spondees, or a mixture of both. The scheme of this verse then is—

⏑ ⏑ | – ⏑ ⏑ | – ⏑ ⏑ | – ⏑ ⏑ | – ⏑ ⏑ | – ⏑
or, – – | – ⏑ ⏑ | – – | – ⏑ ⏑ | – – | – ⏑

with all the varieties which the mingling of the two kinds of feet affords. In modern poetry the hexameters has been frequently used. In English hexameters accent is almost entirely substituted for length, and trochees generally take the place of spondees. Longfellow in his Evangeline, Kingsley in his Andromeda, and Clough in his Bothie have adopted this form of verse. The following lines are specimens of Clough's English hexameters:

O let us | try, he | answered, the | waters them | selves will sup | port us, |
Yea very | ripples and | waves will | form to a | boat under | neath us.

HEX'ASTYLE, in architecture, a term

Hexastyle front of the ancient Roman temple called the Maison Carrée, at Nimes, France.

applied to a portico or temple which has six columns in front.

HEYSE (hī'zė), Paul Johann Ludwig, German novelist and dramatist, born at Berlin 1830, settled at Munich in 1854. He has written many plays, and short stories for newspapers and magazines, but his fame rests on his great novels, Die Kinder der Welt (The Children of the World), 1872; and Im Paradiese (The Paradise Club), 1875; generally recognized as among the most powerful and artistic works of modern German fiction.

HEZEKI'AH, the twelfth, and one of the best of the kings of Judah. He succeeded Ahaz about 717 B.C., and died about 698 B.C.

HIBERNATION. See Dormant State.

HIBER'NIA, the ancient name of Ireland, applied to it first by Julius Cæsar. Aristotle mentions this island by the name of Ierne; Pomponius Mela calls it Iverna; Ptolemy, Iuvernia.

HIBERNIANS, Ancient Order of, a society instituted originally for the protection of the Catholic priesthood and religion in Ireland, but it has now as its main object "the advancement of the principles of Irish nationality." According to some authorities the order was first instituted in 1642, following the great uprising in the north; according to others, in 1651, when Cromwell had proclaimed nearly the whole native population outlawed, and had put a price upon the head of every priest and made it death to attend a Catholic service. The founder was Rory Og O'Moo, and the society was at first known as The Defenders. On the establishment of Catholic emancipation, in 1829, the society was reorganized under its present name as a beneficial and nationalist organization. It was introduced into the United States in 1836. Its membership is restricted to persons of Irish birth or descent and of Catholic faith. Military drill is a prominent feature in some of the branches. The order is an active supporter of the present Gaelic movement, having endowed a Celtic chair at the Catholic University of America, and contributed generously toward the support of Gaelic organizers in Ireland.

HIBIS'CUS, an extensive genus of plants, chiefly natives of tropical climates. They have large showy flowers, borne singly upon stalks toward the ends of the branches, these flowers hav-

Hibiscus.
a, Flower cut longitudinally. *b*, Stamen. *c*, Fruit. *d*, Embryo.

ing an outer calyx of numerous leaves in addition to the true five-lobed persistent calyx. They are chiefly shrubs, one or two being herbs, and a few attaining the dimensions of trees. The species are remarkable for abounding in mucilage and for the tenacity of the fiber of their bark, whence several are employed for many economical purposes in the different countries where they are indigenous.

HICCUP, or HICCOUGH, is a convulsive catch of the respiratory muscles, with sonorous inspiration, repeated at short intervals. Though generally a trivial and transient inconvenience, its occurrence in the last stages of acute disease is a grave, and often a fatal symptom. The frequent swallowing of small pieces of ice, or small doses of anti-spasmodic medicines, usually relieves a severe fit.

HICK'ORY, the name given to several species of timber-trees. They are natives of North America, and are remarkable for stateliness and general beauty. The wood is heavy, strong, and tenacious, and is used for making carriage-shafts, screws, whip-handles, cogged wheels, etc. The shag-bark yields the hickory-nut of commerce, and its wood is very valuable.

Flowering branch and fruit of hickory.
a, Male flower, *b*, Female flower.

HIDALGO, a Spanish nobleman of the lower class. There were hidalgos de naturaleza, of noble birth, and hidalgos de privilegio, that is, those on whom the king had conferred nobility, and those who purchased nobility. The title is now obsolete.

HIDES, the skins of animals, either raw or dressed; but the name is more commonly given to the undressed skins of the larger domestic animals, as oxen, horses, etc., the smaller being called skins. The hide trade is now an important one.

HI'ERARCHY, sacred government, sometimes the church, sometimes the rule which the ecclesiastical governing body exercised as at once priests and civil magistrates. In the former sense the hierarchy arose with the establishment of the Christian church as an independent society. In the middle ages the papal hierarchy gathered great strength, and the pope became a spiritual monarch, ruling western Christendom with power but feebly limited by princes and councils. A reactionary movement began in the 14th century, and the general tendency of subsequent events has always been to make the civil and hierarchical power more and more independent of each other. The term hierarchy as used to denote the governing and ministering body in the church, according to its several gradations, can strictly be applied only to those churches which are ruled by bishops, such as the Roman Catholic Church and the Anglican Church, which also holds the theory of a hierarchical gradation of rank and authority. Both these churches comprise the three orders of bishops, priests, and deacons.

HIEROGLYPHICS, a term originally applied to the inscriptions sculptured on buildings in Egypt, in the belief that the writing was confined to sacred subjects, and legible only to the priests. The term has also been applied to picture-writing in general, such as that of the Mexicans and the still ruder pictures of the North American Indians. Three different modes of writing were used by the ancient Egyptians, the Hieroglyphic, the Hieratic, and the Demotic. Pure hieroglyphic writing is the earliest, and con-

sists of figures of material objects from every sphere of nature and art, with certain mathematical and arbitrary symbols. Next was developed the hieratic or priestly writing, the form in which most Egyptian literature is written, and in which the symbols almost cease to be recognizable as figures of objects. Hieratic writings of the third millennium B.C. are extant. In the demotic or enchorial writing, derived directly from the hieratic, the symbols are still more obscured. The demotic was first used in the 9th century B.C., and was chiefly employed in social and commercial intercourse. Down to the end of the 18th century scholars failed to find a clue to the hieroglyphic writings. In 1799, how-

Cartouche of Cleopatra.

ever, M. Bouchard, a French captain of engineers, discovered at Rosetta the celebrated stone which afforded European scholars a key to the language and writing of the ancient Egyptians. It contained a trilingual inscription in hieroglyphics, demotic characters, and Greek, which turned out to be a decree of the priests in honor of Ptolemy V., issued in 195 B.C. The last paragraph of the Greek inscription stated that two translations, one in the sacred and the other in the popular Egyptian language, would be found adjacent to it. The discovery of an alphabet was the first task. The demotic part of the inscription was first examined by De Sacy and Akerblad, and the signification of a number of the symbols ascertained. The hieroglyphic part was next carefully examined and compared with the demotic and Greek. At last after much study Champollion and Dr. Thomas Young, independently of each other, discovered the method of reading the characters (1822), and thus provided a clue to the decipherment of the ancient Egyptian writing.

Hieroglyphic characters are either ideographic, i.e. using well-known objects as symbols of conceptions, or phonetic, i. e. representing words by symbols standing for their sounds. The phonetic signs are again divided into alphabetical signs and syllabic signs. Many of the ideographic characters are simple enough; thus the figure of a man, a woman, a calf, indicate simply those objects. Others, however, are less simple, and convey their meaning figuratively or symbolically. Water was expressed by three zigzag lines, one above the other, to represent waves or ripples of running water, milk by a milk-jar, oil by an oil-jar, fishing by a pelican seizing a fish; i.e. fishing; seeing and sight by an eye; and so on. The nature of the phonetic hieroglyphs, which represent simply sounds, will be understood from an explanation of the accompanying cuts.

1. The first hieroglyph in the name of Kleopatra is a knee, which is kne or kle in Coptic, and represents the K of Kleopatra. K does not occur in the name Ptolemaios. 2. The second hieroglyph in Kleopatra is a lion couchant, which is laboi in Coptic, and labu in the old Egyptian, and represents the L of both names. In Kleopatra it occupies the second place, and in Ptolemaios the fourth. 3. The third hieroglyph in Kleopatra is a reed, which is aké in Coptic and aak in the old Egyptian, and represents the E of Kleopatra. The reed is doubled in Ptolemaios and occupies the sixth and seventh places, where it represents the diphthong ai of Ptolemaios. 4. The fourth hieroglyph in Kleopatra is a noose, which represents the O of both names, and occurs in the third place of Ptolemaios. 5. The fifth hieroglyph in Kleopatra is a mat, which represents the P of both names, and is the initial of Ptolemaios. 6. The sixth hieroglyph in Kleopatra is an eagle, which is akhoom in Coptic, and represents the A, which is found twice in the name Kleopatra, but does not occur in the name Ptolemaios, although the diphthong ai occurs as described above, No. 3. 7. The seventh hieroglyph in Kleopatra is a hand, which is toot in Coptic, and represents the T of Kleopatra, but does not occur in Ptolemaios, where it might be expected to occupy the second place. The second place of Ptolemaios is occupied by a semicircle, which is found at the end of feminine proper names, and is the Coptic feminine article T. The researches of Champollion satisfied him

Cartouche of Ptolemy.

of the existence of homophones, or characters having the same phonetic value and which might be interchanged in writing proper names. 8. The eighth hieroglyph in Kleopatra is a mouth, which is ro in Coptic, and represents the R of Kleopatra. 9. The ninth hieroglyphic in Kleopatra is the eagle, which is explained in No. 6 above. 10. The semicircle is the T of Ptolemaios, which with 11, the egg found at the end of proper names of women, is a feminine affix. In the name of Ptolemaios there is still the M and the S to account for. The fifth hieroglyph in the cartouche of Ptolemaios is a geometrical figure, consisting of three sides of (probably?) a parallelogram, but now called a hole, because the Coptic mu has that signification, and represents the M. The hook represents the S of the word Ptolemaios. Vowels were only regarded by the Egyptians as they were needed to avoid ambiguous writing.

There are groups of hieroglyphs of which one element is an ideographicl sign, to which a phonetic complement is added to indicate the pronunciation of the ideographic sign. The words of a text could be written in hieroglyphs in three ways—1. By phonetic hieroglyphs; 2. By ideographie hieroglyphs; and 3. By a combination of both. According to Ebers, in the perfected system of hieroglyphics the symbols for sounds and syllables are to be regarded as the foundation of the writing, while symbols for ideas are interspersed with them, partly to render the meaning more intelligible, and partly for ornamental purposes, or with a view to keep up the mystic character of the hieroglyphics.

HIGGINS, CHARLES; editor; born in Brooklyn, N. Y., 1860; began his career as editor in Toronto, Canada; removed to Chicago in 1878, managing editor of Americanized Encyclopædia; editor World's History and its Makers.

HIGH CHURCH, a term applied to a party in the Church of England. It was applied first to a party among the younger clergy during the latter part of the reign of Elizabeth who asserted that Calvanism was inconsistent with the ancient doctrine and constitution of the primitive church, and who claimed a divine right for episcopacy. Bishop Andrewes was the chief writer of this party, and Laud became its most active leader. The term now generally refers to those who exalt the authority and jurisdiction of the church, and attach great value to ecclesiastical dignities

HIGH GERMAN, originally the Teutonic dialect spoken in the southern and elevated parts of Germany, as distinguished from Platt Deutsch or Low German, spoken in the northern and more lowland portions of Germany. See Germany.

HIGHLANDS OF SCOTLAND, a somewhat vague and indefinite geographical division of Scotland, n. and w. of a line running n.e. from Dumbarton on the Clyde through the counties of Dumbarton, Stirling, Perth, Forfar, Kincardine; then n.w. through Aberdeen, Banff, Moray, and Nairn to the shores of the Moray Firth. The Highlands are generally subdivided into two parts, the West Highlands and the North Highlands; the former of which contains the shires of Argyll and Bute, the Southern Hebrides, and part of Perth and Dumbarton.

HIGH PLACES, in scripture, eminences or mounds on which sacrifices were offered. Altars and places of worship were erected from early times on high places, for the worship of Jehovah. Latterly such a practice, as leading to idolatrous observances, was strictly forbidden among the Jews. High places are frequently mentioned in conjunction with groves.

HIGH-PRIEST, the head of the Jewish priesthood. In the books of Moses the holder of this dignity is simply designated the priest; the epithet high occurs on one or two occasions, but as a distinctive epithet it appears to have been added subsequently. The formal consecration of Aaron, the brother of Moses, together with his sons, to a hereditary priesthood, is recorded in Exod. xxviii. The high-priesthood continued in the tine of Aaron, sometimes in one, and sometimes in another branch of it, until the coming of Christ. From B.C. 153 till the time of Herod the Great the regal and priestly authority were united in members of the Asmonæan family (the

Maccabees). After the subjugation of the Jews the high-priesthood was often arbitrarily conferred by the foreign masters. In the time of our Saviour it appears to have been held by several priests alternately.

HIGH-SEAS, the open sea or ocean. The claims of various nations to exclusive rights and superiority over extensive tracts of the ocean-highway have been settled after much controversy by a general international law. The principle now accepted is that the jurisdiction of maritime states extends only for 3 miles, or within cannon range of their own coasts; the remainder of the seas being high-seas, accessible on equal terms to all nations. Inland seas and estuaries, of course, are excepted.

HIL'DRETH, Richard, American historian, was born at Deerfield, Mass., in 1807. He graduated at Harvard college in 1826, studied law, and began to practice in Boston in 1830. In 1832, however, he abandoned his profession to become editor of the Boston Atlas. In 1840 appeared his Despotism in America, a work on the political, economical, and social aspects of slavery. The work however, for which he is most remembered is his History of the United States, in six volumes (1849–56), in which he presents the founders of the republic in their true character, without trying to heighten their virtues or disguise their mistakes and faults. In 1855 Hildreth published Japan as It Was and Is, and in 1856 Atrocious Judges, based on Campbell's Lives. For several years, ending with the inauguration of Lincoln as president, he was engaged on the staff of the New York Tribune. He went abroad in the summer of 1861 as United States consul at Triest, and died in Florence in 1865.

HILL, Ambrose Powell, American soldier, was born in Culpepper co., Va., in 1825. He graduated at the United States military academy in 1847, entered the first artillery, and was made second lieutenant. He served in the Mexican war and afterward on the frontier and in Florida. Later he was promoted to captain. At the outbreak of the civil war he entered the confederate service, was appointed colonel of the thirteenth regiment Virginia volunteers, and ordered to Harper's Ferry. He fought at the first battle of Bull Run, and at Chancellorville it was his troops who, on being moved to the front, mistook Jackson's escort for federals and fired the fatal volley that caused Jackson's death. On the reorganization of his army in 1863 Lee gave one corps to Hill and at the same time made him lieutenant-general. He was killed in 1865 at Petersburg while reconnoitering.

HILL, Daniel Harvey, American soldier and educator, was born in South Carolina in 1821. He served in the Mexican war and was brevetted major. In 1861 he entered the confederate service and commanded at the battle of Big Bethel, and was soon afterward promoted to brigadier-general. He was appointed lieutenant-general in 1863 and was placed in command of a corps in General Bragg's army. From 1877 until 1884 he was president of the Arkansas industrial university, and from 1885 until his death of the Middle Georgia military and agricultural college. He died in 1889.

HILL, David Bennett, American politician, was born in Havana, N. Y., in 1843. He was admitted to the bar in 1864, and in 1870–71 served in the state legislature. In 1882 he was elected mayor of Elmira; in November of the same year, lieutenant-governor of New York state, and in 1884, when Grover Cleveland resigned the position of governor, Mr. Hill took his place. In 1885 he was elected governor for the term expiring in 1888, and was re-elected in that year. He was a prominent candidate for the presidency on the democratic ticket in 1892. He became United States senator for New York state, but failed of re-election because the state legislature elected in 1896 was republican.

HILL, James J., American railway promoter, was born near Guelph, Ont., in 1838. In 1870 he formed the Red River transportation company, which was the first to open communication between Saint Paul and Winnipeg. Eight years afterward he helped to form the syndicate which, under another name, ultimately built the Canadian Pacific railway. From 1883 to 1893 he interested himself in the building of the Great Northern railway, extending from Lake Superior to Puget Sound, with northern and southern branches and a direct steamship connection with China and Japan.

HILL, Sir Rowland, K.C.B., English postal reformer, born at Kidderminster 1795, died 1879. In 1837 he published a pamphlet recommending the adoption of a low and uniform rate of postage throughout the United Kingdom. The scheme was approved by a committee of the House of Commons, which examined its details in 1838, and early in 1840 the penny postage system was carried into effect with the assistance of Mr. Hill, who, for this purpose, received an appointment in the treasury. In 1846 he received a public testimonial of the value of upward of $65,000. In 1846, he was made secretary to the postmaster-general, and in 1854 chief secretary to the post office. In 1860 he became K.C.B. He retired from the post office four years later with a pension of $10,000, besides a grant of $100,000 voted by parliament.

HILL, Rowland (Viscount Hill), British general, born 1772, died 1842. He entered the army in his sixteenth year, obtained the rank of captain in 1793, and became colonel of the 90th Regiment in 1800. He took part in the Egyptian campaign, and in 1806 was made major-general. In 1809 he became lieutenant-general; in 1812 he was made a K.B.; and in 1814, a peer by the title of Baron of Almarez, and of Hawkstone. At Waterloo he commanded the right wing of the British, and he was personally thanked by Wellington for his services. In 1828 he was appointed general commanding-in-chief of the British army, a post which he held till 1842, when he retired and was made a viscount.

HILLEL, Jewish rabbi, born at Babylon about B.C. 112. He came to Jerusalem, it is said, at about forty years of age, became president of the Sanhedrim and founder of the school of Hillel. Shammai, another member of the Sanhedrim, became the head of a rival and hostile school. Hillel's party was the more liberal of the two, and became the dominant one.

Viscount Hill.

HIMALAYA, a chain of snowy mountains in Asia, the most elevated on the earth, which separates the Indian Peninsula from the plateau of Tibet, between the 72d and 96th degrees of e. lon., or between the Indus on the west and the Brahmaputra on the east; length about 1500 miles, average breadth about 180 miles. The great plains of India, south of the Himalaya, has a general elevation of 1000 feet above the sea. The general height of the Himalayas is double that of the Alps; the passes over the former ordinarily exceed, often by half a mile, the elevation of Mont Blanc. The Ibi-Gamin pass in Garhwal, the highest of all, is 20,457 feet, the Mustagh 19,019 feet, the Parangla 18,500 feet, the Kronbrung 18,313 feet, and the Dura Ghat 17,750 feet high. There are several summits in the Himalaya which approach closely to double the absolute elevation of the highest of the Alps, and 120 of them are stated to be above 20,000 feet. The rivers of the Punjab ("Five Waters") spring from a portion of the great chain which may be considered a distinct group under the title of the northwestern Himalaya. Some of the peaks here rise to a height of 24,000 to 25,000 feet; or to 28,278 feet if the Karakorum is regarded as part of the Himalayas. In the Central or Middle Himalaya rise the sources of the Ganges and Jumna, in a region regarded by the Hindus as holy ground. Farther eastward, in Nepal, is the highest part of the Himalya, as far as it is known and measured. Dhawalagiri has an elevation of 26,826 feet, the Gaurisankar or Mount Everest, the highest known mountain in the world, is 29,002 feet; the Yassa group rises to the height of 26,680 feet, the Ibjibia group to 26,306. Going farther east, in Sikkim, or on its borders, we find Kanchinjinga, the western peak of which is 28,156 feet high, the eastern, 27,815 feet, while the Kabru ridge rises to 24,015 feet. Sikkim forms a comparatively narrow but interesting territory, walled in on three sides by stupendous mountains from 17,000 to 28,000 feet high. Here ter-

minates the region of the Middle Himalaya, most of the streams from which unite in the Ganges. The eastern Himalaya, which extends from Sikkim east to the Brahmaputra and completes the chain, sends all its waters to the last-named river, and is all comprised in Bhutan. A little to the east of Sikkim, Chamalari attains the height of 23,944 feet. About 250 miles further east a conspicuous group has been observed with two peaks, named the Gemini or Twins, 21,500 feet high. Thence toward the east the mountains sink rapidly, but the range may be traced beyond the right bank of the Brahmaputra. This stream, as well as the Indus, rises on the little-known north side of the Himalaya, their sources not being far apart. The snowy ridge of the Himalayas, as far as examined, consists everywhere of granite, with which are immediately associated gneiss and mica-slate, followed, in descending, by metamorphic and secondary rocks till we arrive at the more recent alluvial deposits. Earthquakes are still frequent within this region; and hot springs gush forth in abundance, even from beneath the snow. The limit of perpetual snow in the middle division (lon. 78° e.) is stated to be about 15,500 feet on the south side and 18,500 feet on the northern. In Sikkim the snow-line descends on the south side to 14,500 feet, while on the north it rises to a level of 19,600 feet. Immense glaciers exist at various parts. The vegetation of the Himalayas is very rich, there being forests of pine, spruce, silver-fir, and deodar cedar at suitable elevations, with rhododendrons in profusion. Among the more characteristic animals are the yak, musk-deer, wild sheep, etc.

The snowy range of Himalayas, from Marma.

HINDUS, or **HINDOOS.** See India.

HINDUSTAN', the name commonly given to the whole Indian empire, but which properly applies only to the Punjab and the valley of the Ganges. See India.

HINDUSTA'NI, one of the chief languages of India, having various forms or dialects. When written in the Persian character, and containing many Persian words and phrases, it is known as Urdu; another form of it is Hindi.

HIP-JOINT, the joint of the hip, a ball-and-socket joint formed by the reception of the globular head of the femur or thigh-bone into the socket or acetabulum of the os innominatum. For flexion, extension, rotation, and strength combined it is the most perfect joint in the body.

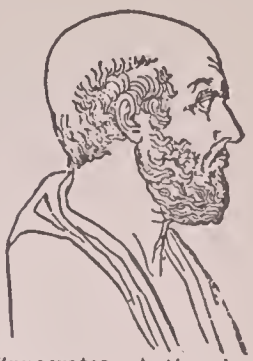
HIPPAR'CHUS, ancient Greek astronomer, was born at Nicæa in Bithynia, and lived about B.C. 160–125. He resided for some time at Rhodes, but afterward went to Alexandria, then the great school of science. A commentary on Aratus is the only work of his extant. He first ascertained the true length of the year, discovered the precession of the equinoxes, determined the revolutions and mean motions of the planets, prepared a catalogue of the fixed stars, etc.

HIP'PIAS, ruler of Athens, son of Pisistratus, after whose death (B.C. 527) he assumed the government, in conjunction with his brother Hipparchus. His tyranny became at last unbearable, and he was expelled from the city B.C. 510.

HIPPOCAM'PUS, a genus of fishes, closely allied to the pipe-fishes, of singular construction and peculiar habits; the upper parts have some resemblance to the head and neck of a horse in minature, which has suggested the name. When swimming they maintain a vertical position; their general length is from 6 to 10 inches, and they occur in the Mediterranean and Atlantic.

Hippocampus.

HIPPOC'RATES, the most famous among the Greek physicians, the father of medicine, born in the island of Cos B.C. 460. Besides practicing and teaching his profession at home he traveled on the continent of Greece, and died at an advanced age B.C. 357, at Larissa, in Thessaly.



Hippocrates.—Antique bust.

HIP'PODROME, the Greek name for the public place where the horse and chariot races were held. In Byzantine times the hippodrome at Constantinople acquired great renown, and factions originating in the hippodrome caused perpetual confusion in all departments of the public service. The name is sometimes applied to a modern circus.

HIPPOGRIFF, a fabulous animal or monster, half-horse, and half-griffin.

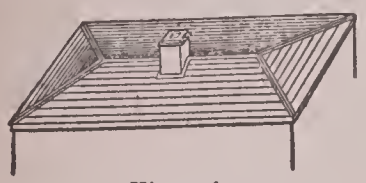
HIPPOL'YTUS, in Greek mythology, son of Theseus, whose stepmother, Phædra, fell in love with him, and accused him to his father in order to avenge herself for his indifference. He was put to death, but his innocence being afterward established, Phædra destroyed herself. See Phædra.

HIPPOPOT'AMUS, the typical genus of a family of Ungulates, of which two living species are known. One species is of large size, and is common throughout the greater part of Africa; the other, is not only smaller, but has other important differences, and is found only in the African west coast rivers, and those flowing into Lake Tchad. The former species has a thick and square head, a very large muzzle, small eyes and ears, thick and heavy body, short legs terminated by four toes, a short tail, two ventral teats, skin about 2 inches thick on the back and sides, and without hair, except at the extremity of the tail. The incisors and canines of the lower jaw are of great strength and size, the canines or tusks being long and curved forward. These tusks sometimes reach the length of 2 feet and more, and weigh upward of 6 lbs. The animal is killed by the natives partly as food, but also on account of the tusks and teeth, their hardness being superior to that of ivory, and less liable to turn yellow. The hippopotamus has been found of the length of 17 feet, and stands about 5 feet high. It delights in water, living

Hippopotamus.

in lakes, rivers, and estuaries, and feeding on water-plants or on the herbage growing near the water. It is an excellent swimmer and diver, and can remain under water a considerable time. The behemoth of Job is considered by commentators to be the hippopotamus, as the description of his size, manners, food, and haunts it not unlike those of the latter animal. Among the ancient Egyptians it was revered as a divinity, as it is among the negroes in some localities. Several extinct species are found in old-world tertiary and diluvial formations.

HIP-ROOF, a roof, the ends of which slope so as to have the same inclination



Hip-roof.

to the horizon as its other two sides, being thus of a triangular form.

HISPANIA. See Spain.

HISPANIO'LA. See Hayti.

HISSAR', a town of Hindustan, in the Punjab, administrative headquarters of district of the same name, on the western Jumma canal, 102 miles w. of Delhi. Pop. 17,000. The district has an area of 5163 sq. miles. Pop. 776,006.

HISTOL'OGY, the study of the tissues which enter into the formation of animals and plants, and their various organs, by means of the microscope and chemical and physical reagents. It may be described as a kind of minute anatomy. It comprehends the structure and mode of development of the various tissues, and is divided into animal histology and vegetable histology.

HISTORY, is used by Herodotus in the sense which it has since retained, of a narrative of events and circumstances relating to man in his social or civic condition. A record of bare facts by themselves does not constitute history. Such a record (forming a chronicle or annals) is chronologically valuable; but to attain the dignity of history we must have social events and evolution detailed with considerable fulness, and the growth and movements of society, from one phase to another, distinctly traced and recorded. The modern school of historians devote much attention to the social life of the people; their method being further characterized by the utmost accuracy, of research the extreme importance assigned to contemporary documentary evidence, and careful weighing of data.

HITCHCOCK, Edward, American geologist, born 1793, died 1864. He was connected with the state survey of Massachusetts, Vermont, and part of New York, valuable reports on which he published. He was author of various other works, some geological and some of miscellaneous character. These include Geology of the Connecticut Valley, a highly popular work on Elementary Geology, Illustrations of Surface Geology, Religion of Geology and its Connected Sciences, and Reminiscences, published shortly before his death.

HITCHCOCK, Roswell Dwight, D.D., LL.D., American theologian, born 1817, died 1887. He entered Andover theological seminary in 1838, and was successively professor of natural and revealed religion in Bowdoin, of church history at New York, president of the American Palestine exploration society, and president of Union theological seminary.

HITTITES, a Canaanitish nation first mentioned in connection with Abraham, who bought the field and cave of Machpelah from them. There are notices of them in Palestine during and after the captivity. Egyptian and Assyrian inscriptions seem to indicate that the nation consisted of a confederacy ruled by a number of chiefs, and at one time there was a Hittite empire extending over a large area in Asia Minor and Syria. Their chief territory was in the Orontes Valley.

HOANG-HO, or YELLOW RIVER, a large river in China, the sources of which are in mountains in the Koko-Nor territory, north from Tibet. After a winding course of several hundred miles, it proceeds nearly due north to about lat. 41°; then east for nearly 200 miles, when it suddenly bends round, and flows directly south for about another 200 miles; then turns abruptly east, and flows in that direction till it reaches Lung-men-kau, when it diverges to the north-east, and falls into the Gulf of Peche-le about lat. 37° 30′, and lon. 118° 30′. From the 13th century till 1853 the Hoang-Ho entered the sea in lat. 34°, south of the peninsula of Shan-tung, but at the latter date it took its present course. Since then vast sums have been spent in watching and strengthening the banks of the river, which is constantly overflowing at some point. In the autumn of 1887 the whole body of the river burst its banks about 300 miles from its mouth, and flooded about one-sixth of the province of Ho-nan, destroying towns and villages and causing a loss of life, the lowest estimate of which is one million. Its length is estimated at about 2600 miles. It derives its name from the vast quantities of yellow earth held in a state of solution by its waters.

HOAR, George Frisbie, American legislator, was born at Concord, Mass., in 1826. He was elected to congress in 1869 and was a member until 1877, when he was chosen senator and continuously re-elected until his death in 1904. Though he supported President McKinley for re-election, he strongly opposed his policy in the Philippines, which he considered subversive of American ideals.

HOARSENESS, an affection of the throat causing harshnesss and roughness of voice, due to irregular and imperfect bringing together of the vocal chords, most frequently from swelling of the mucous membrane of the chords, and excessive secretion of mucus in their neighborhood. It arises from a variety of causes, the most common of which is catarrh or cold. Simple hoarseness is treated with soothing remedies, the inhalation of the steam of boiling water, warm poultices to the neck, etc.

HOBART, Garret Augustus, American lawyer and politician, was born at Long Branch, N. J., in 1844. He was a member of the state assembly from 1873 to 1878 and of the state senate from 1879 to 1885. He was successively delegate at large for five times to the republican national convention. He was nominated at St. Louis in 1896 for vice-president on with McKinley and was elected to that office. He died in 1899.

HOBBES, Thomas, English moral and political philosopher, born 1588 at Malmesbury, died 1679. The most remarkable of his works is his Leviathan, or the Matter, Form, and Power of a Commonwealth (1651). Other works are De Cive (1642), De Corpore Politico (1650), De Libertate, Necessitate et Casu (1654), and Behemoth, a history of the civil war, published after his death. He also published a metrical version of the Iliad and Odyssey.

HO'BOKEN, a city in New Jersey, on the Hudson river, and close to Jersey City, which stretches immediately to the south. It lies opposite New York, with which it is connected by steam ferries. It has various manufactories, and among the public institutions is the Steven's institute of technology, with library and valuable scientific apparatus. Pop. 1909, about 75,000.

HOBSON, Richard Pearson, an American naval constructor, was born in 1870 in Greensboro, Ala. He entered the Southern university in 1882, but three years afterward accepted an appointment to the United States naval academy, where he graduated in 1889. During the war with Spain he was present at the bombardment of Matanzas, and took part in the expedition against San Juan de Puerto Rico; but his great achievement was the sinking of the collier Merrimac across the entrance to Santiago harbor before daylight, on June 3, 1898, in order to "bottle up" Cervera's fleet. After the war he raised and refitted several of the Spanish warships which had been sunk. He resigned from the navy in 1903. Among his publications are The Disappearing Gun Afloat, and the Sinking of the Merrimac. In 1906 he was elected to the United States Congress.

HOCHE, (ōsh), Lazare, general in the French revolutionary war, born 1768. He took service in the French guards when sixteen years old, and at the revolution joined the popular party. He greatly distinguished himself at the siege of Thionville and the defense of Dunkirk, and shortly afterward, when scarcely twenty-five years of age, received the command of the army on the Moselle. In 1793 he drove the Austrians out of Alsace, and soon after was arrested by the Jacobins and imprisoned at Paris. In 1794 he was released, and appointed commander of the army destined to quell the rising in the west, and afterward to that in La Vendée. In 1796 he conceived the plan of attacking Britain, by making a descent on Ireland. He accordingly set sail in December from Brest, but the expedition utterly failed, and he was obliged to return without having even effected a landing. After his return he received the command of the army of the Sambre and Meuse. He opened the campaign of 1797 by a bold passage over the Rhine, and had defeated the Austrians

in several engagements, when he was stopped in the path of victory by the news of the armistice concluded in Italy. He died suddenly in September same year (1797).

HOCK, the name given to the German wines grown in the Hochheim district (see Hochheim). It is a white still wine, but is sometimes rendered sparkling. The name is also loosely applied to all the Rhenish wines.

HOCKEY, a game at ball known as shinty in Scotland, and hurling in Ireland. It is played with a club curved at the lower end, by a number of persons divided into two parties or sides; and the object of each side is to drive the ball into that part of the field marked off as their opponents' goal.

HOE, an instrument for cutting up weeds and loosening the earth in fields and gardens, in shape something like an adze, being a plate of iron, with an eye for a handle, which is set at a convenient

Horse-hoe.

angle with the plate. The Dutch hoe differs from the common hand hoe in having the cutting blade set like the blade of a spade. A horse-hoe is a frame wheel-mounted, and furnished with ranges of shares spaced so as to work in the intervals between the rows of turnips, potatoes, etc. It is used on farms for the same purpose as the hand hoe, and worked by horse-power.

HOG, a general name for the ungulate or hoofed animals, or swine. The head is prolonged into a pointed or truncated snout; the feet have four toes, two of which reach the ground; and the skin is very thick, and mostly covered with stiff bristles. The common hog in a tame state, is almost universal, except in very high latitudes. The prevailing color of the domestic animal is a dull yellowish white, sometimes marked irregularly with black, and sometimes totally black. It is omnivorous in its habits, devouring almost any vegetable or animal substance. It is also very prolific, has usually two litters in a year, a litter consisting of from ten to even twenty. The wild-boar, from which most of our domesticated varieties are derived, is found in most parts of Europe and Asia. In size ,the wild animal considerably exceeds the domesticated hog, the legs are longer and more muscular, and the back therefore much higher. Hunting this animal has always been a favorite amusement, and can still be practiced in various parts of Europe.

HO'GARTH, William, painter and satirical artist, born in London, 1697, died 1764. In 1729 he married the daughter of Sir James Thornhill, the painter, against her father's wishes, who is said, however, to have been mollified when Hogarth produced his celebrated series of pictures called the Harlot's Progress, a work which brought his great powers fairly before the public. The engravings of these, which became exceedingly popular, were published in 1734. This was followed by the Rake's Progress and Marriage à la Mode, two similar series of paintings and engravings, Industry and Idleness, Beer Street and

William Hogarth.

Gin Lane, The Election, The Enraged Musician, The Country-Inn Yard, The March to Finchley, Strolling Actresses Dressing in a Barn, Four Stages of Cruelty, and a host of other engravings, which all evinced his extraordinary powers of satire, wit, and imagination. The best edition of his works is that published by Boydell (London, 1790), the plates of which, retouched by Heath and others, have been repeatedly published since.

HOGSHEAD, an obsolete measure of capacity containing 63 old wine gallons, or 52½ imperial gallons. For beer it was 54 gallons, for rum 45 to 50 gallons, for brandy 45 to 60 gallons. In the United States the measure is still in use, being equivalent to 63 American gallons or 52.485 imperial gallons; for tobacco it varies from 750 lbs. in some states to 1200 lbs. in others.

HOHENZOLLERN (hō-en-tsol'ĕrn), a small territory of Germany, since 1852 administrative division of Prussia. It consists of a long, narrow, irregular strip of country, entirely surrounded by Würtemberg and Baden. Area, 450 sq. miles. Pop. 66,720. The princely family of Hohenzollern dates from Thassilo, Count of Zollern, who died about 800 A.D. There have been several lines and branches, the main one being represented by the present imperial family of Germany.

HOLBACH (hol'bah), Paul Heinrich Dietrich, Baron von, philosopher, born at Heidelsheim, in the Palatinate, in 1723. He was educated in Paris, where he passed the greater part of his life, and died in 1789. He contributed many papers on natural history, politics and philosophy to the Encyclopédie. His principal work was the System of Nature. According to Holbach matter is one form of existence and everything is the effect of a blind necessity.

HOLBEIN (hol'bīn), Hans, an eminent German painter, born at Augsburg in 1497. He studied under his father, Hans Holbein the elder, a painter of considerable merit (1450–1526), and at an early age settled at Basel, where he exercised his art till about 1526. He then came to England, where letters from his friend Arasmus, whose Panegyric on Folly he had illustrated by a series of drawings, procured him the patronage of the chancellor Sir Thomas More. He was appointed court painter by Henry VIII.; and in the Windsor collection has left portraits of all the eminent Englishmen of the time. The most celebrated of his pictures are the Madonna at Darmstadt (better known through the replica at Dresden), representing the Burgomaster Meyer and his wives kneeling to the Virgin; and the Solothurn Madonna. His famous Dance of Death has only been preserved in the engraving of Lützelburger. There are a considerable number of engravings on wood and copper from Holbein's designs. He died at Whitehall of the plague in 1543.

HOLBERG, Ludwig, Baron, the father of modern Danish literature, was born at Bergen, in Norway, then part of the Danish dominions, in 1684; died at Copenhagen January 27, 1754. His works may be divided into four classes—poems, stage pieces, philosophical treatises, and historical works. His poems are

Hans Holbein, the younger.

chiefly of a satirical nature. The most celebrated is Peder Paars, a comic heroic poem in fourteen cantos, which is still regarded throughout the Scandinavian countries as a masterpiece. Almost equally famous is his Nicolas Klimm's Subterraneous Travels, a satirical romance in prose.

HOLD, the whole interior cavity or belly of a ship, or all that part of her inside which is comprehended between the floor and the lower deck throughout her length.

HOLIBUT. See Halibut.

HOLIDAY, any day set apart as a religious or national festival; in a general sense a day or a number of days during which a person is released from his every day labors.

HOLLAND, a fine and close kind of linen, so called from its being first manufactured in Holland; also a coarser linen fabric, unbleached or dyed brown, used for covering furniture, books, carpets, etc., or for making window-blinds or the like.

HOLLAND, North, and Holland, South, two provinces of the Netherlands. The greater part of the former consists of a peninsula, bounded by the North Sea on the w. and the Zuider-Zee on the e. Area, 1054 sq. miles. It lies

very low, some portions of it being at least partially below the level of the sea, and it is generally fertile. A broad margin of downs or sand-hills protects it from the sea on the west. Besides rivers (Vecht, Amstel, Zaan, etc.), it is intersected by the Great North Holland canal. The chief towns are Amsterdam, Alkmaar, Haarlem, Helder, and Zaandam. Pop. 968.105.—South Holland, the most populous province of the Netherlands, is bounded on the north by North Holland, on the west by the German Ocean. The southern part of the province is broken up into several islands. Area, 1155 sq. miles. Like North Holland, it is a flat and depressed tract, and it also is protected from the sea on the west by a margin of downs or sand-hills. The chief river is the Rhine, with its numerous branches. The lakes were formerly numerous, but most of them are now drained. The soil is fertile and well cultivated. The principal towns are Delft, Dort, Gorkum, Gouda, Leyden, Rotterdam, Schiedam, 's Gravenhage (the Hague). Pop. 1,114,401.

HOLLY, a genus of plants embracing a number of evergreen trees or shrubs. The common holly is common in Britain and the Continent of Europe. It is a handsome, conical evergreen tree, growing to the height of 20 or 30 feet. Its leaves are dark-green, shining, and leathery, abundantly armed with prickles on the lower branches, but free from

American holly.
a b, Female and male flowers.

them on the upper, or on very old trees. The flowers are white, appearing in May; the fruit is red, ripening in September, and remaining on the tree al the winter. A good many varieties are known ,distinguished by the shape and color of the leaves, which are sometimes spotted or edged with yellow, etc. It is excellently adapted for hedges and fences, as it bears clipping. The wood is hard and white, and is employed for turnery work, knife handles, etc. The bark yields a mucilaginous substance, from which birdlime is made. Among the Romans it was customary to send boughs of holly to friends, with new-year's gifts, as emblematical of good wishes; and it is used to decorate houses at Christmas. The American holly is widely diffused throughout the United States. It sometimes attains the height of 80 feet, with a trunk 4 feet in diameter.

HOLLYHOCK, a biennial plant, a native of China, and is a frequent ornament of gardens. There are many varieties, with single and double flowers, characterized by the tints of yellow, red, purple, and dark purple approaching to black.

HOLMES, Mary Jane, American novelist, was born in Brookfield, Mass., 1839. Her first novel, Tempest and Sunshine (1854), was followed by a book almost every year, and the circulation of her books has exceeded two millions. Died 1907.

HOLMES (hōmz), Oliver Wendell, M.D., LL.D., American writer born at Cambridge, Mass., 1809, and educated at Harvard university. He began the study of law, but in a short time relinquished it for that of medicine. In 1839

he became professor of anatomy and physiology in Dartmouth college, N. H., but resigned after two years' service in order to devote himself to practice in Boston. In 1847 he was appointed to the chair of anatomy at Harvard, a position which he filled till 1882. He was a voluminous writer both in prose and verse, and shone as a prominent figure in the famous group associated with the Atlantic Monthly. His chief works, besides several volumes of poems, and treatises on medicine, are The Autocrat of the Breakfast Table, The Professor at the Breakfast Table, and The Poet at The Breakfast Table; Elsie Venner, The Guardian Angel, A Mortal Antipathy, and Memoirs of Motley and Emerson. A visit to Europe in 1886 produced a charming record: A Hundred Days in Europe. He died in 1894.

HOLY ALLIANCE, a league concluded at Paris, Sept. 26, 1815, between Alexander I., emperor of Russia, Francis, of Austria, and Frederick William III. of Prussia, and signed with their own hands, and without the countersign of a minister. It consisted of a declaration, that, in accordance with the precepts of the gospel of Jesus Christ, the principles of justice, charity, and peace should be the basis of their internal administration, and of their international relations, and that the happiness and religious welfare of their subjects should be their great object. Its real aim, however, was to maintain the power and influence of the existing dynasties. It was offered for signature to all the European powers except the pope and the sultan of Turkey, and accepted by all except Britain. The events of 1848 broke up the Holy Alliance.

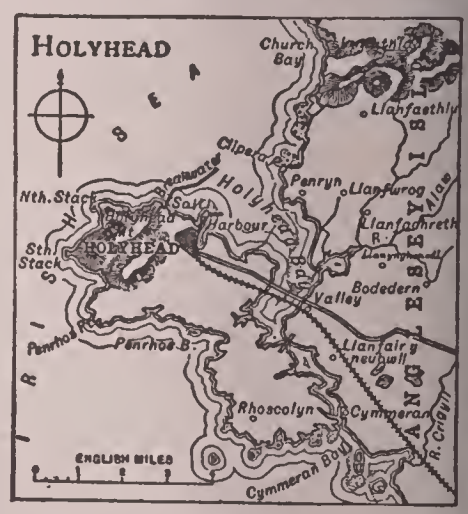
HOLY COAT OF TREVES, a relic preserved in the cathedral of Treves, and said to be the identical seamless coat worn by our Saviour at his crucifixion, and for which the soldiers cast lots. It was the gift of the Empress Helena, by whom it was discovered in her visit to Palestine in the 4th century. It has been exhibited to vast numbers of pilgrims at irregular intervals. The same claim is made for several coats kept in other places.

HOLY FAMILY, in art, representations of the infant Saviour and his mother, accompanied by one or more members of his family.

HOLY GHOST, according to Trinitarians, the third person in the Holy Trinity; according to the Socinians, a Biblical metaphor, to designate the divine influence. The doctrine of the Athanasian creed adopted by Roman Catholics, Lutherans, and Calvinists alike, is that the Holy Ghost proceeded from both Son and Father, and is coeternal and equal with both. The Eastern Church, however, following the Council of Alexandria held in 362, asserts that the Holy Ghost proceeds from the Father alone.

HOLY GHOST, Order of, an order of male and female hospitallers, founded by Guy, son of William, Count of Montpellier, toward the end of the 12th century, for the relief of the poor, infirm and foundlings.

HOLYHEAD, an island and seaport town of North Wales, in the county of Anglesey. The island is about 7 miles long and 5 miles broad at the widest part,



is situated off the west side of Anglesey, and is connected with the mainland by a causeway. The town is on the northeast side of the island, and owes its prosperity to the railway and steamboat traffic between England and Dublin. The harbor of refuge (Victoria harbor), opened in 1873, is formed by a breakwater which is 7860 feet in length, the whole cost, including some minor works, being $7,500,000. Pop. 11,414.

HOLY LAND. See Palestine.

HOLYOKE, a city in Hampden co., Mass., on the w. bank of the Connecticut river. It has manufactures of paper, cotton, wool, wire, machine works, etc. Pop. 1909, about 54.000.

HOLY PLACES OF JERUSALEM, a term meant to apply more particularly to that group of localities of which the Church of the Holy Sepulcher is the

Scale of English Miles
10 0 10 20 30
Railways thus

NORTH SEA

Mouths of the Schelde, Maas and Rhine

Mouth of the Rhine

Hond or West Schelde

East Schelde

Over Flakee

Eock van Holland

Goedereed Gat

Brouwershaven Gat

Schouwen

Duiveland

Tholen

Voorne

R. Maas

Ostende

Nieuwpoort

Dunkerque

Gravelines

Calais

Boulogne

Terschelling

W. Terschelling

Vlieland

Texel

Cocksdorp

Den Burg

De Helder

Oude schild

Marsdiep

Nieuwe Diep

Wieringen

Kinderdijk

Stavoren

Harlingen

Makkum

Dokkum

Lauwers Zee

Uithuizen

Uithuizermeeden

Rottum

Eemshaven

Delfzijl

Appingedam

Emden

The Dollart

Leeuwarden

Franeker

Sneek

Sneeker Meer

Workum

Hindeloopen

Stavoren

Slooten

Heerenveen

Akkrum

Oudeschild

Molkwerum

Nieuwe Diep

Wierum

Dokkum

Lauwers Zee

Uithuizen

Uithuizermeeden

Rottum

Eemshaven

Delfzijl

Appingedam

Emden

The Dollart

GRONINGEN

Groningen

Winschoten

Bedum

Winsum

Zuidlaarder Meer

Leek

Haren

Slochteren

Scheemda

Oldehove

Bierum

Warfum

Uithuizermeeden

Rottum

Eemshaven

Delfzijl

Appingedam

Emden

The Dollart

FRIESLAND

Sneek

Sneeker Meer

Oudeschoot

Drachten

Dokkum

Lauwers Zee

Uithuizen

Uithuizermeeden

Rottum

Eemshaven

Delfzijl

Appingedam

Emden

The Dollart

Achlum

Bolsward

Harlingen

Makkum

Workum

Hindeloopen

Stavoren

Slooten

Heerenveen

Akkrum

Oudeschild

Molkwerum

Nieuwe Diep

Wierum

Dokkum

Lauwers Zee

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Uithuizen

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Rottum

Eemshaven

Delfzijl

Appingedam

Emden

The Dollart

DRENTHE

Assen

Borger

Zandberg

Meppel

Hoogeveen

Emmen

Coevorden

Steenwijk

Zwolle

Odoorn

Beilen

Hoogeveen

Emmen

Coevorden

Steenwijk

Zwolle

Odoorn

OVERYSSEL

Hasselt

Zwolle

Kampen

Deventer

Almelo

Oldenzaal

Ommen

Hardenberg

Ootmarsum

Enschede

Delden

Holten

Goor

Hengelo

Haaksbergen

Almelo

Oldenzaal

Ommen

Hardenberg

Ootmarsum

Enschede

Delden

Holten

Goor

Hengelo

Haaksbergen

ZUIDER ZEE

Medemblik

Enkhuizen

Vollenhove

Urk

Schokland

Kampen

Elburg

Harderwijk

Hattem

Nunspeet

Elburg

Harderwijk

Hattem

Nunspeet

Medemblik

Enkhuizen

Vollenhove

Urk

Schokland

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Petten

Schagen

Medemblik

Enkhuizen

Vollenhove

Urk

Schokland

Kampen

Elburg

Harderwijk

Hattem

Nunspeet

Egmond

Alkmaar

Beverwijk

Castricum

Wijk-aan-Zee

Uitgeest

Zaandam

Monnikendam

Edam

Volendam

Marken

Monnikendam

Edam

Volendam

Marken

Monnikendam

Edam

Volendam

Marken

center, some of the other more celebrated objects being the Garden of Gethsemane, the Church of the Ascension, the Tomb of the Virgin, etc., all connected with the life and passion of our Saviour. The guardianship of the holy places has been a cause of much contention between the Greek and Latin churches. They were formerly under the control of the latter, but since 1757 they have been committed to the care of the Greek Church by imperial ordinance of the Porte. Demands made respecting the holy places and the protection of Greek Christians in Turkey, led to the Crimean war of 1854–76.

HOLY ROMAN EMPIRE, a title which the German Empire received in 962 when Otho I. was crowned at Rome by Pope John XII. It came to an end when Francis II. became hereditary emperor of Austria in 1804.

HOLYROOD, Palace and Abbey of, in Edinburgh, at the eastern extremity of the old town. The abbey church, founded in 1128 by David I., containing the royal vault, with the ashes of numerous members of the Scottish royal race, is now mostly in ruin.

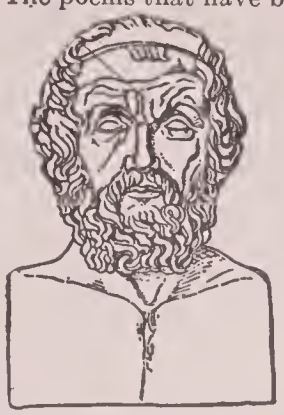
HOLY SEPULCHER, Knights of the, an order of knighthood founded by Godfrey of Bouillon, 1099, for the guardianship of the Holy Sepulcher at Jerusalem, and for the protection of pilgrims. It was revived by Pope Alexander VI., 1496, and reorganized in 1847 and 1868.

HOLY WATER, in the Greek and Roman Catholic Church, salted water which has been consecrated by prayers, exorcism, and other ceremonies, to sprinkle the faithful and things used for the church. It is placed at the door of churches, so that worshipers may sprinkle themselves with it as they enter, and it is used in nearly every blessing which the church gives. Sprinkling the people with holy water seems to date from the 9th century, and it is considered efficacious not from any virtue of its own, but from the effect of the church's prayers at the time of using.

HOLY WEEK, or **PASSION WEEK,** is that which immediately precedes Easter, and is devoted especially to commemorate the passion of our Lord. The days more especially solemnized during it are Spy Wednesday, Maundy Thursday, Good Friday, and Holy Saturday. It is an institution of very early origin, and is known as Great Week, Silent Week, Penitent Week, etc. Spy Wednesday was a name given in allusion to the betrayal of Christ by Judas Iscariot. Maundy or Holy Thursday specially commemorates the institution of the Eucharist.

HOMAGE, in feudal law, a formal acknowledgment made by a feudal tenant to and in presence of his lord on receiving the investiture of a fief or coming to it by succession, that he was his vassal. The tenant, being ungirt and uncovered, kneeled and held up both his hands between those of the Lord, who sat before him, and there professed that "he did become his man, from that day forth, of life and limb, and earthly honor," and then received a kiss from his lord.

HOMER, an ancient Greek epic poet, of whom nothing is known with certainty, some even doubting whether he ever existed. The most probable opinion is that he was a native of some locality on the sea-board of Asia Minor, and that he flourished between 950 and 850 B.C. The earliest mention of the name of Homer is found in Xenophanes (6th century B.C.). The common statement that he was blind may safely be discarded. The poems that have been gen-



Homer.—Ancient bust.

erally attributed to Homer are the Iliad and Odyssey. The Batrachomyomachia, of Battle of the Frogs and Mice, and certain hymns to the gods also passed under his name, though belonging to a later period. The Iliad in its present form consists of twenty-four books, and tells the story of the siege of Troy from the quarrel of Achilles with Agamemnon to the burial of Hector, with subordinate episodes. The Odyssey is also in twenty-four books, and records the adventures of Odysseus (Ulysses) on his return voyage to his home in Ithaca after the fall of Troy. Even as early as the beginning of the Christian era, certain Greek critics (the Separatists) maintained that the two poems were the work of different poets, but the general belief continued to be that there was one author for both. The entire system of Homeric criticism, however, was revolutionized in 1795 by F. A. Wolf in his Prolegomena to Homer. He asserted that the Iliad and Odyssey were not originally committed to writing, and were not two complete and independent poems, but originally a series of songs of different poets (Homer and others), celebrating single exploits of heroes and first connected as wholes by Pisistratus, about 540 B.C. Some of Wolf's arguments have been proved erroneous, but since his time the old views in regard to the Iliad and Odyssey have been held by comparatively few of the ablest scholars, though what theory is now the most common is difficult to say. Among the most conservative theories is that which assigns to Homer a central or basal portion of both Iliad and Odyssey, to which additions by other poets were gradually united; but generally the Odyssey is regarded as of somewhat later date than the Iliad, and not by the poet who produced the Iliad in its original form.

HOME RULE, in British politics, a measure which has been more especially advocated in regard to Ireland. The leading feature of the Irish home rule party seems to be the establishment of a native parliament in Ireland to conduct all local and internal legislation, leaving the general political government of the empire to an imperial parliament. The movement originated in the formation of the Home Government association at Dublin, in 1870, under the presidency of Mr. Isaac Butt. At the general election of 1874 the party succeeded in sending 60 home rule members to parliament for Irish constituencies. The elections of 1885 and 1886 still further strengthened the party, 86 members following the lead of Mr. Parnell (which see). The original scheme has been materially modified since Butt's time, and there are not wanting Irishmen who declare openly for absolute independence, which many believe to be the ultimate aim of the whole party. The conversion of Mr. Gladstone and many members of the liberal party to home rule principles has added immense strength to the movement. Similar schemes for Scotland and Wales have been agitated.

HOME-SICKNESS, in medicine, Nostalgia, a disease arising from an intense and uncontrolled feeling of grief at a separation from one's home or native land. It is most frequent among persons who leave mountainous and go to flat countries, as the Scotch Highlanders and Swiss, or among those who change from the country to the town. It commences by a deep melancholy, is sometimes accompanied by low, nervous, hectic fever, or occasionally changes into phthisis, and may terminate fatally.

HOMESTEAD, a city in Allegheny co., Pa., on the Monongahela river, and the Penn. and the Pitts. and Lake Erie railways; 8 miles s.e. of Pittsburg. It contains one of the largest steel-manufacturing plants in the United States. It also has manufacturers of glass and firebrick. Pop. 14,974.

HOMESTEAD LAWS, the laws of the United States give to every citizen who is the head of a family, or who has arrived at the age of twenty-one years, the right to a homestead of 160 acres, to be selected at will from any of the surveyed and otherwise unappropriated public lands, without cost, except entry fees. The tract thus taken as a homestead must be located in a compact body, upon land which is agricultural in character, and must conform to the legal subdivisions established by the official survey. To obtain a homestead the applicant must make an affidavit that he is over the age of twenty-one years, or the head of a family; that he is a citizen of the United States, or has declared his intention to become such; and that the entry is made for his exclusive use and benefit, and for actual settlement and cultivation. Where homestead entries are made by soldiers and sailors who served ninety days or more in the United States army or navy during the war of the rebellion, the period of their service, or, if they were discharged on account of wounds or disability incurred in the line of duty, the entire term of enlistment, not to exceed four years, is deducted from the five years' residence required by law. But no one can receive a title to his homestead under any circumstances without having lived upon it at least one year.

HOMICI'DAL MANIA, a species of mania in which a sudden irresistible im-

pulse to destroy life seizes the patient. It is independent of hatred toward the victim, or of any appreciable motive, and its causes are obscure.

HOMICIDE, the killing of one man or human being by another. In law, homicide is of three kinds—justifiable, excusable, and felonious; justifiable, when it proceeds from unavoidable necessity, as where the proper officer inflicts capital punishment, where an officer of justice kills an offender who assaults or resists him and who cannot otherwise be captured, or where persons are killed in the dispersion of rebellious or riotous assemblies; excusable, when it happens from misadventure, as where a man in doing a lawful act by accident kills another, or in self-defense, as where a man kills another in defense of the life of himself, his wife, children, parent, servant, etc.; felonious, when it proceeds from malice, or is done in the prosecution of some unlawful act, or in a sudden passion. Self-murder also is felonious homicide. Felonious homicide comprehends murder and manslaughter.

HOMILET'ICS, the art of preaching; that branch of practical theology which teaches the principles of adapting the discourses of the pulpit to the spiritual benefit of the hearers, and the best methods which ministers of the gospel should pursue for instructing their hearers by their doctrines and example.

HOMILY, a discourse or sermon read or pronounced to an audience on some subject of religion; a discourse pronounced in the church by the minister to the congregation. The ancient homily was sometimes simply a conversation, the prelate talking to the people and interrogating them, and they in turn talking to and interrogating him.

HOMŒOP'ATHY, the name of a system of medicine introduced by Samuel Hahnemann of Leipzic (died 1843). It is a system founded upon the belief that drugs have the power of curing morbid conditions similar to those they have the power to excite, an old belief long ago expressed in the Latin phrase "similia similibus curantur" (like is cured by like). In contradistinction to this system the more common method of treating diseases has been termed heteropathy or allopathy. In practice homœopathy is associated with the system of administering infinitesimal doses.

HONAN', a once populous city of China, in the province of same name, on an affluent of the Hoang-ho. The province has an area of 65,104 square miles. It is generally level, and is watered by the Hoang-ho and its affluents. The soil is fertile and carefully cultivated; the forests in the west supply timber; and mines yield tutenag or Chinese copper, cinnabar, mica, etc. Honan suffered severely from the inundation of the Hoang-ho in 1887; capital, Kai-fung. Pop. 22,117,036.

HONDO, the name given by the Japanese to the chief island in their empire. In many geographical works Nippon or Niphon is the distinctive appellation of this island, but by the Japanese themselves that name is applied to the whole country. The area of the island is 87,425 sq. miles, and the pop. 33,327,935. See Japan.

HONDU'RAS, a republican state of Central America; area, 39,600 sq. miles. Its surface is hilly with numerous fertile valleys. Its mineral wealth is very considerable, and includes gold, silver, lead, and copper. The chief rivers are the Chamelicon, Ulua, and Aguan, flowing to the Caribbean Sea, and the Choluteca, an affluent of the Pacific. There are extensive forests abounding in fine timber. The principal cultivated productions are corn, beans, some wheat, rice, plantains, and tobacco. Since 1880 the capital has been Tegucigalpa, the principal ports are Truxillo on the Caribbean Sea, and Port San Lorenzo, in the Pacific. The constitution of the state gives the legislature power to a congress of deputies composed of thirty-seven members. The executive authority is in the hands of the president. The resources of the country are undeveloped, and the finances are in a very disordered state. Pop. 590,000.

HONDURAS, BRITISH, or **BELIZE,** a British colony of Central America, having north and west, Yucatan; west and south, Guatemala; and east, the Bay of Honduras. Area, 7562 sq. miles. Pop. 32,899 including about 400 whites.

HONE, the name given to several varieties of slaty stones employed in whetting knives, razors, or other edge-tools. They are usually pieces of hard close-grained clay-slate, containing minute particles of quartz, with a uniform consistence. The best-known varieties are the Ayr stone, so called from being found in the river Ayr, in Scotland; the Charnley Forest stone, found in Charnwood Forest, Leicestershire; the German hone, the Canada oil-stone, Turkey oil-stone, etc.

HONEY, a vegetable product, with saccharine properties, collected by bees from the blossoms of flowers, and deposited in the cells of their combs. The best is clear and transparent, and solidifies when kept for some time into a granular, white mass. Some varieties of it are dark yellow or brownish in color. Spring honey is more esteemed than summer honey; and the latter more than that of autumn. Virgin honey is taken from hives in which the bees have never swarmed, and it is of a white color. Yellow honey is extracted from all sorts of combs. The flavor of honey largely depends on the plants from which it is collected. Honey is obtained in large quantities in many countries, partly from wild bees, but chiefly from those kept in hives. In addition to its ordinary domestic uses, it is employed medicinally as a promoter of expectoration, to sweeten certain medicines, to make a gargle with vinegar, etc. It is also used in making mead. The ancients used it as we do sugar, and made of it and wine a mixture very much liked.

HONEY-ANT, inhabiting Mexico, and living in communities in subterranean galleries. In summer a certain number of these insects secrete a kind of honey in their abdomens which become so distended as to appear like small pellucid grapes. Later in the season when food is scarce these ants are devoured by the others, and they are also dug up and eaten by the inhabitants of the country.

HONEY-COMB, a waxen cellular structure framed by the bees to deposit their honey and eggs in. The wax is secreted by the insect in the form of small and thin oval scales in the folds of the abdomen. The comb is composed of a number of cells, most of them exactly hexagonal and arranged in two layers placed end to end, the openings of the layers being in opposite directions. The comb is placed vertically, the cells being therefore horizontal. The sides of the cells are very thin, and yet the whole structure is of considerable strength. Some cells are destined for the exclusive reception of honey; others for the reception of larvæ.

HONEY-DEW, a sweet saccharine substance found on the leaves of trees and other plants in small drops like dew. There are two kinds; one secreted from the plants, and the other deposited by aphides. Different kinds of manna are the dried honey-dew or saccharine exudations of certain plants.

HONEY-EATER, the name given to a number of insessorial birds forming the family Meliphagidæ, of the tribe Tenuirostres. They form a numerous group, feeding principally on honey and the

Wattled honey-eater.

nectar of flowers. They are natives of Australia and the adjacent islands. They have long curved sharp bills, with tongues terminating in a pencil of delicate filaments, to enable them the better to extract the juice of flowers.

HONEY-LOCUST, SWEET LOCUST, or **BLACK LOCUST,** a forest tree belonging to the United States. The leaves are pinnated, divided into numerous small leaflets and the foliage has a light and elegant appearance; the flowers are greenish, and are succeeded by long, often twisted pods, containing large brown seeds, enveloped in a sweet pulp. This tree is especially remarkable for its formidable thorns, on which account it has been recommended for hedges.

HONEYSUCKLE, or **WOODBINE,** the common honeysuckle of Britain, a twining shrub, with distinct leaves and red berries, is indigenous in Great Britain; but two others have been naturalized. The honeysuckle family is represented in North America by nine different species.

HONG-KONG, an island off the s.e. coast of China, belonging to the British, at the mouth of the estuary that leads to Canton, from which it is distant 75 miles. It is about 10 miles in extreme length and 7½ miles in extreme breadth, separated from the mainland by a narrow strait, and with Cowloon on the mainland forms a crown colony, area 32 sq

miles. Hong-Kong is a great entrepôt for the foreign commerce of China, and is a free port, without customs' dues. It is also a station of the British fleet. The revenue of the government is derived from the land rents, licenses to sell opium, spirits, etc., taxes, postages, fines, fees of office, etc. Hong-Kong was ceded to Britain in 1842; some 200 sq. miles additional were leased in 1898. Pop. about 246,000; more than nine-tenths being Chinese, and 11,000 whites.

HONOLU'LU, the capital of the Sandwich Islands, south side of the island of Oahu. Its most notable edifices are the royal palace, the Roman Catholic cathedral, the treasury, the parliament house, etc. There is a fine natural harbor. Honolulu is a rapidly improving place. Pop. 45,670.

HONOR, Knights and Ladies of, a fraternal benevolent society organized in Kentucky in 1877 for social and beneficial purposes. The central authority is the supreme lodge, and the chief officer has the title of supreme protector. The order has sixteen grand lodges and 1160 subordinate lodges, representing a total membership of 63,000.

HONOR, Maids of, ladies in the service of European queens, who attend their mistress when she appears in public. In England they are eight in number.

HONORABLE, Right Honorable and Most Honorable, titles given in the United Kingdom to peers, their families, and certain public functionaries. (See Address, Forms of.) In America the governors of states, judges, members of congress, and others holding offices of dignity and trust, are styled honorable.

HONORS, Military, compliments or salutes paid by troops to royalty, officers of rank, etc., or given at funerals to all grades of the army.

HOOBLY, or Hubli, a town of India in Dhàrwàr district, Bombay Presidency, a great centre of the cotton trade. Pop. 60,214.

HOOD, John Bell, American soldier, was born in Owingsville, Ky., in 1831. In 1861 he entered the confederate army and during the first years of the war took part in the Virginia campaigns. He lost a leg at Chicamauga and in the following spring he again took the field and was made lieutenant-general. After being repeatedly defeated and repulsed by both Sherman and Thomas, and after his army had been driven in utter rout by Thomas, Hood was relieved of his command at his own request. He died in 1879.

HOOD, Robin, a celebrated outlaw, who, according to the popular account, with his followers, inhabited Sherwood Forest, in Nottinghamshire, and also the woodlands of Barnsdale in the adjoining West Riding. What basis of fact there is for the story of Robin Hood is doubtful. Grimm maintained that he was one with the Teutonic god Woden. Other theories suppose him to have been a rebel yeoman in Lancaster's rebellion under Edward II.; a Saxon chief who defied the Normans; and a fugutive follower of Sir Simon de Montfort after the battle of Evesham.

HOOD, Samuel, Viscount, a British admiral, born 1724, died 1816. He joined the navy as a midshipman in 1740, and attained the rank of post-captain in 1759. Having become rear-admiral, he preserved the island of St. Christopher's from being taken by De Grasse, assisted in the defeat of De Grasse by Rodney in 1782, and was rewarded with the title of Baron Hood of Catherington in the Irish peerage. In 1793 he commanded against the French in the Mediterranean, and captured Toulon and Corsica. In 1796 he was made an English peer, with the title of Viscount Hood.

HOOD, Thomas, an English poet and humorist, of Scotch extraction, born at London, 1799, died 1845. It was during his last illness that he contributed to Punch The Song of a Shirt, The Bridge of Sighs, and The Lay of a Laborer. Hood is unrivaled as a punster, and he possesses a singular power of combining the humorous with the pathetic. He had the satisfaction of knowing that the pension of $500 conferred upon him on his last illness by Sir Robert Peel was to be transferred to his wife.

HOOD, MOUNT, a peak of the Cascade range on the western border of Wasco co., Ore. It is 50 miles east by south of Portland. It has an altitude of 11,934 feet and there are no formidable obstacles to its ascent. The summit commands an extensive and magnificent view.

HOODED SEAL, a species of seal, the male of which possesses a movable, inflatable muscular bag, stretching from the muzzle to about five inches behind the eyes. The prevailing color is bluish black—the head and limbs being uniformly black. Its usual range extends in America southward to Newfoundland, and in Europe to Southern Norway.

HOODED SNAKE. See Cobra de Capello.

HOOFS, the horny tissues which constitute the external part of the feet of certain animals, mostly herbivorous. They may be regarded as homologues of the toe-nails of other animals. They are composed of epithelium cells, agglutinated and dried, and of intercellular substance and cell contents. Chemically they consist of keratin.

HOOKER, Joseph, American soldier, was born at Hadley, Mass., in 1814. He served against the Seminoles and in the Mexican war. He accompanied the army from Vera Cruz to Mexico City and was brevetted major. At Chapultepec he was brevetted lieutenant-colonel. He was engaged at the siege of Yorktown, and on the day after its evacuation was appointed a major-general of volunteers. Later he became division commander in the army of Gen. Pope, Virginia. On the failure of Gen. Pope to advance against the enemy, the army of the Potomac was again led by Gen. McClellan, and Gen. Hooker took command of the first corps. He was shot through the foot, and soon afterward was appointed brigadier-general in the regular army. He was placed on the retired list in 1868, with the full rank of major-general. He died in 1879.

HOOKER, MOUNT, one of the loftiest peaks of the Rocky Mountains. It has an estimated elevation of 15,700 feet.

HOOPER, John, an English reformer, born 1495, burnt 1555. His works consist chiefly of a Godly Confession and Protestation of the Christian Faith, Lectures on the Creed, Sermons on the Book of Jonah, Annotations on the Thirteenth Chapter of the Romans, and expositions of several psalms.

HOOPING-COUGH, or **WHOOPING-COUGH,** a disease known by a rapid series of coughs ending in a long-drawn breath, during which a shrill whistling sound, the hoop, is produced. Two or three such fits of coughing follow one another, until some phlegm is expelled, and vomiting may occur. During a severe spasm the face becomes swollen and purplish, as if suffocation were threatened. It is evidently due to a poison acting as an irritant on the pneumogastric nerve. It is contagious, and most commonly attacks children, and generally only once in their lives. The whooping-cough usually comes on with a difficulty of breathing, and other slight febrile symptoms, which are succeeded by a hoarseness, cough, and difficulty of expectoration. After a fortnight or more the cough becomes convulsive, and is attended by the hoop. After four or five weeks the expectoration becomes loose, and the fits of coughing gradually diminish in frequency and duration. Hooping-cough is seldom fatal to adults, but is the most fatal disease in the first year of childhood. Bronchitis and pneumonia are the most serious complications.

HOOPOE, a bird forming the type of a family generally classed with the bee-eaters or the honey-eaters, but also with with hornbills. The European hoopoe (U. epops) is about 12 inches long; it has

Hoopoe.

a fine crest of pale cinnamon-red feathers tipped with black; upper surface on the whole ashy-brown; wings black, the coverts having white bars; throat and breast pale fawn; abdomen white, with black streaks and dashes. It has a very wide range, from Burmah to the British Islands and Africa. It is a ground-feeder, preying chiefly on insects, and seems to delight in filth; it nests in cavities of trees or walls, and its eggs vary from four to seven. The hoopoe utters a loud double or treble hoop, whence its name.

HOOSAC TUNNEL, the longest railway tunnel in America, in the western part of Massachusetts, on the railway from Boston to Troy, N. Y. It pierces the Hoosac Mountain, the summit range extending southward through Massachusetts from the Green Mountains of Vermont. It is 4¾ miles long, and has a double line of rails.

HOP, a plant of Europe, and of the United States, where it occurs wild. The root is perennial, giving out several herbaceous, rough, twining stems, with large lobed leaves; the fertile flowers are green; the fruit is a catkin, and the plant is cultivated for the sake of the catkins, which are employed to communicate to beer its aromatic bitter. The young shoots are sometimes boiled and eaten

Hop.

like asparagus; the fibers of the old stems make good cords. The cultivation of the hop is more carefully attended to in England than in any other country, Kent being the chief county in which it is grown; but the plant is also extensively reared in other parts of Europe, as also in North America, Australia, New Zealand, etc. The use of the hop catkins depends upon a peculiar bitter substance which they contain, called lupulin which is a yellow powder, containing a bitter principle and a volatile oil. The lupulin constitutes from 10 to 12 per cent by weight of the catkin, and the bitter principle forms from 8 to 12 per cent of the lupulin. Having tonic, stomachic, and narcotic properties hops are often used medicinally. Pillows stuffed with hops are used to induce sleep.

HOP-FLY, a species of plant-louse very destructive to the hop. The winged female is green with a black head and bands and spots of black on the body; the legs and wings are long. A few winged females make their first appearance about the middle of May, and wingless myriads by the middle of June. The insects suck the under side of the upper leaflets, and there deposit their young on the most suculent part of the plant. Myriads perish by means of ladybirds and other insects, as well as by their extreme susceptibility to atmospheric changes.

HOPKINS, Johns, American financier and philanthropist, was born in Anne Arundel co., Md., in 1795. In addition to minor gifts to individuals and charities, he founded and endowed two great institutions which perpetuate his name —the Johns Hopkins university and Johns Hopkins hospital, whose activities are united in the Johns Hopkins medical school. He died in 1873.

HORACE. See Horatius Flaccus.

HORÆ, in classical mythology, the goddesses of the seasons and the order of nature. Their number was indefinite; in Athens two only were worshipped. They are represented as blooming maidens carrying the different products of the seasons.

HORATII, three Roman brothers, who, according to tradition, in the reign of Tullus Hostilius engaged three Alban brothers (the Curiatii), in order to decide the supremacy between Rome and Alba. Victory went to Rome, and the sole surviving Horatius was triumphantly conducted back to the city. But his sister had been bethrothed to one of the Curiatii, and her demonstrative grief so enraged Horatius that he stabbed her. For this he was condemned to death, but his father and the people begged him off.

HORATIUS COCLES, a hero of ancient Rome. The Tarquins having, after their banishment, sought refuge with the Etrurian king Porsenna, the latter advanced against Rome (B.C. 507) to restore them. According to tradition Horatius Cocles, along with two companions, held the Sublician bridge against the enemy, while the Romans broke it down behind them. When this was nearly finished he sent back his two companions, and as the bridge fell he plunged into the Tiber with his armor and safely reached the opposite bank.

HORATIUS FLACCUS, Quintus, commonly known as Horace, the greatest of Latin lyric poets, was born near Venusia, in southern Italy, B.C. 65. His father was a freedman, a collector of taxes, and had purchased the farm at which his son was born. His poems procured him the friendship of Virgil and Varius, and to them he was indebted for his first acquaintance with Mæcenas, who was the friend and confident of Augustus Cæsar, and who expended his wealth for the encouragement of literature and the arts. His works consist of four books of odes; a book of epodes or short poems; two books of satires; and two books of epistles, one of which is often cited as a separate work, under the title of Ars Poetica.

HOREHOUND, a labiate plant, with whitish, downy leaves and stem; flowers small, nearly white, in crowded whorls, possessing an aromatic smell and bitter

Horehound.

flavor. It is a popular remedy for coughs and colds, usually as an infusion. Black horehound, also a labiate plant, is a malodorous and unattractive weed.

HORI'ZON, in ordinary speech the line where earth and sky seem to meet, or the circle which bounds that part of the earth's surface visible to a spectator from a given point. This is termed the sensible, visible, or apparent horizon, as distinguished from the rational or celestial horizon, an imaginary great circle parallel to the sensible horizon, whose plane passes through the earth's center, whose poles are the zenith and the nadir, and which divides the sphere into two equal hemispheres. In observations with the sextant at sea, when the real horizon is invisible a small basin containing mercury may serve as an artificial horizon. The observation that is then made is the angle between the sun o star and the image of the sun or star i the basin of mercury, and it is easily seen that half this angle is the altitude o the object above the real horizon. I geology, the term is applied to any well marked formation which suffices as starting point from which to study th rest.

HORN, a general term applied to al hard and pointed appendages of th head, as in deer, cattle, etc., but as a term denoting a particular kind o substance nothing should be called hor which is not derived from the epidermi or outer, layer of the integument whether on the trunk, hoofs, or head Horn is a tough, flexible, semi-trans parent substance, most liberally de veloped in the horns of bovine animals but also found in connection with th "shell" of the tortoise, the nails, claws and hoofs of animals, the beak of bir and turtle, etc. Horn is softened ver completely by heat, so as to becom readily flexible, and to adhere to othe pieces similarly softened. True hor consists principally of an albuminoi principle, keratin, with a small portio of gelatine and a little phosphate lime. In some species of animals th males only have horns, as for instanc the stag. In cattle both male and fema have horns, though there are also hor less cattle. Horns differ widely in th case of different animals. Thus the horn of deer consist of bone, and are decidu ous; those of the giraffe are independen bones, with a covering of hairy skin those of oxen, sheep, and antelopes con sist of a hony core covered by a horn sheath. The horns of the rhinocero alone consist exclusively of horny ma ter. The horns of oxen, sheep, goat antelopes are never shod, except in th case of the prong-horned antelope. Th number never normally exceeds fou and in the case of deer the horns a branched.

The various kinds of horns are em ployed for many purposes. The princ pal used in the arts are those of the o buffalo, sheep, and goat. Deer horns a almost exclusively employed for th handles of knives and of sticks an umbrellas. Those which furnish tru horn can be softened by heat (usually boiling water), cut into sheets of vario thickness, which sheets may be solder or welded together at the edges so as form plates of large dimensions, an polished and dyed so as to imitate t much more expensive tortoise-she The clippings of horn may be welded t gether in the same manner, and ma into snuff-boxes, powder horns, hand for umbrellas, knives, forks, etc. horn has the valuable property of taki on and retaining a sharp impressi from a die, many highly ornamental ticles may be turned out. Combs for t hair are made from the flattened shee and out of the solid parts of buff horns beautiful carvings are made.

HORN, a musical instrument, orig ally formed, as the name denotes, fr the horn of an animal. The name cludes a large family of wind-inst ments, many of which have fallen i disuse. The French horn, or simply horn, consists of a metalic tube of ab

10 feet in length, very narrow at top, bent into rings, and gradually widening toward the end whence the sound issues, called the bell. It is blown through a cup-shaped mouthpiece of brass or silver and the sounds are regulated by the player's lips, the pressure of his breath, and by the insertion of the hand in the

1, Coaching-horn. 2, French or orchestral horn. 3, Flügelhorn, or keyed bugle. 4, Post-horn. 5, Hunting-horn.

bell of the instrument. As a simple tube, unprovided with holes, the horn yields only the generating note, and of course would be confined to one key; but by means of crooks the tube can be lengthened, and transposed into any key. By inserting the hand into the bell, which flattens a note, the sounds awanting are produced. The compass of the instrument is three octaves. Music for the horn is always written in the key of C, an octave higher than it is played, with the key of composition marked at the beginning of each movement; thus "corni (or horns) in D" directs the performer which crook he must use to play the notes in the key indicated. The bugle, cornet-a-piston, and sax-horn are allied instruments.

HORNBILLS, a remarkable group of birds confined to Southern Asia and Africa, akin to the kingfishers and the

Rhinoceros hornbill.

toucans, remarkable for the very large size of the bill, and for an extraordinary horny protuberance by which it is surmounted, nearly as large as the bill itself, and of cellular structure within. The rhinoceros hornbill is almost the size of a turkey, of a black color, except on the lower part of the belly and tip of the tail, which are white. It has a sharp-pointed, slightly-curved bill, about 10 inches long and furnished at the base of the upper mandible with an immense appendage in the form of an inverted horn. The skeleton though bulky is very light, being permeated with air to an unusual degree. During incubation the female is plastered up in the hollow of a tree and fed by the male through a small aperture left for the purpose. The hornbills are of arboreal habit, and feed on fruits; but in captivity they take small reptiles, and the Abyssinian species even attack snakes.

HORNBLENDE (-blend), or Amphibole, one of the most abundant and widely diffused of minerals, remarkable on account of the various forms and compositions of its crystals and crystalline particles, and of its exceedingly diversified colors, thus giving rise to almost numberless varieties, many of which have obtained distinct appellations. It is sometimes in regular distinct crystals, more generally the result of confused crystallization, appearing in masses composed of laminæ, acicular crystals, or fibers, variously aggregated. It enters largely into the composition and forms a constituent part of several of the trap-rocks, and is an important constituent of several species of metamorphic rocks, as gneiss and granite. In color hornblende exhibits various shades of green, often inclining to brown, white, and black, with every intermediate shade; it is nearly transparent in some varieties, in others opaque; hardness about the same with felspar; specific gravity, 3.00. Its chief constituents are silica, magnesia, and alumina. The principal varieties are hornblende proper, divided into three sub-varities, basaltic hornblende, common hornblende, and hornblende slate; tremolite, actinolite, nephrite, pargasite, and asbestos.

HORNBOOK, in former times the first book of children, or that in which they learned their letters: so called from

Hornbook.

the transparent horn covering placed over the single page of which it usually consisted, the whole being fixed to a wooden frame with a handle. It generally contained the alphabet in Roman and small letters, several rows of monosyllables, and the Lord's Prayer. The alphabet was usually prefaced with a cross, or was printed in the form of a cross; hence the term Christ-cross row, corrupted into criss-cross row, applied to the alphabet, and by extension to the hornbook.

HORNED-TOAD, a name given to a genus of lizards of toad-like appearance, found in America, west of the Mississippi. There are nine different species, all more or less covered with spine-like scales.

HORNELLSVILLE, a city in Steuben co., N. Y., on the Canisteo river and the Cent. N. Y. and W. and the N. Y., L. E. and W. railways; 58 miles s. of Rochester. The N. Y., L. E. and W. railway has extensive shops here. Pop. 13,218.

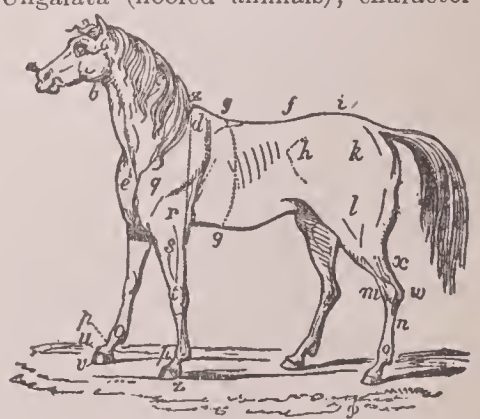
HORNET, an insect much larger and stronger than the ordinary wasp. It is very voracious, feeding on fruit, honey, etc., and preying on other insects. They form their nest of a kind of paper-work in hollow trees and walls, and are able with their sting to inflict a painful wound, usually accompanied with considerable swelling.

HOROL'OGY, the construction of clocks and watches, or branch of knowledge dealing with such.

HO'ROSCOPE, in astrology, a scheme or figure of the twelve houses, or twelve signs of the zodiac, in which is marked the disposition of the heavens at a given time and place, and by which astrologers formerly told the fortunes of persons, according to the position of the stars at the time of their birth. To each of the houses was assigned a particular virtue or influence. The ascendant was that part of the heavens which was rising in the east at the moment; this was the first and most important house, or house of life, and contained the five degrees above the horizon and the twenty-five beneath it. Other houses were those of riches, marriage, death, etc.

HORR, Roswell G., American politician, was born in Vermont in 1830. He was elected in 1872 from Michigan to the United States congress and was re-elected in 1880 and 1882. He was one of the best known campaign speakers in the republican party and in the presidential campaigns of 1884, 1888, 1892, and 1896, toured the country from Maine to California. He died in 1896.

HORSE, a well-known quadruped belonging to the family Equidæ, order Ungalata (hoofed animals); character-



Horse—Terms applied to different parts.

a, Muzzle. *b*, Gullet. *c*, Crest. *d*, Withers. *e*, Chest. *f*, Loins. *gg*, Girth. *h*, Hip or ilium. *i*, Croup. *k*, Haunch or quarters. *l*, Thigh. *m*, Hock. *n*, Shank or cannon. *o*, Fetlock. *p*, Pastern. *q*, Shoulder-bone or scapula. *r*, Elbow. *s*, Fore thigh or arm. *t*, Knee. *u*, Coronet. *v*, Hoof. *w*, Point of hock. *x*, Hamstring. *zz*, Height.

ized by an undivided hoof formed by the third toe and its enlarged horny nail, a simple stomach, a mane on the neck, and by six incisor teeth in each jaw, seven molars on either side of both jaws, and by two small canine teeth in the upper jaw of the male, rarely in the female. The family includes also the asses and zebras, and original types appear to have been at one time common in both the Old World and the American continent. No horses existed in America

when it was discovered by Columbus, those now found in a wild state there, being descendants of those introduced by the Spaniards. But a number of fossil species have been described from America—one of them standing only two and a half feet in height. The descent of the present horse can be traced through several fossil forms back to an animal only about the size of a fox, and having four separate digits or toes on the feet. Subsequent forms show how the third toe developed at the expense of the others till latterly a form identical with the common horse appeared. It is doubtful whether the horse is now anywhere to be found in its native state, the wild horses of the steppes of Tartary and other regions of the Old World being possibly descendants of animals escaped from domestication. The horse was probably first domesticated in Asia, and it varies much in form, size, and character with the climate and nature of the district it inhabits. Arabia produces perhaps the most beautiful breed, which is also swift, courageous, endurant, and persevering. As bred in America the horse has attained high perfection. Two breeds—namely, the large, powerful, black breed of Flanders, and the Arabian—have contributed more than all others to develop the present varieties from the original, comparatively light-limbed, wiry race. The former laid the foundation of size, strength, and vigor for draught-horses and for those anciently used in war, while the latter conferred speed and endurance. The ladies' palfrey is largely derived from the Spanish genet, a small, beautiful, fleet variety of the Moorish barb. The hunter, characterized by speed, strength, and endurance, represents the old English, Flanders, and Arabian breeds. The race-horse has less of Flemish and more of Arabian blood. Carriage, riding, and other horses combine the above breeds in varying degrees, as speed, strength, size, etc., are required. Horses are said to have "blood" or "breeding" in proportion as they have a greater or less strain of Arab blood. At the age of two years the horse is in a condition to propogate. The mare carries her young eleven months and some days, continues to breed till the age of sixteen or eighteen years, and lives on an average between twenty and thirty years. The various species of the horse family have been artificially crossed by man, and are found to be fertile with each other; the offspring, however, are generally sterile. The horse is, strictly speaking, an herbivorous animal, and is more scrupulous in the choice of his food than most other domestic quadrupeds. The staple diet on which horses are kept is oats and hay, with beans added for horses subjected to heavy work. As a substitute for, or an addition to the regular food, bran, linseed, and carrots are used. The age of a horse can be told by the marks on its teeth, which change a little yearly until the animal is about nine years old, after which period it is difficult to determine the age by mark. In some countries the flesh of the horse is used as food; the hide is made into leather; and the hair of the mane and tail is used for making haircloth, for upholsterers' stuffing, etc.

HORSE-CHESTNUT, a handsome genus of trees or shrubs having large opposite digitate leaves, and terminal panicles of showy white, yellow, or red flowers. The common horse-chestnut is familiar to every one. The seeds are large and farinaceous, and have been used as food for animals; they are bitter, and the bark also is bitter, astringent, and febrifugal. The tree is said to have been brought from Constantinople to England in the beginning of the 16th century, and is supposed to be a native of Northern Asia. Three other species are found in North America, where they are popularly known under the name of Buck-eye.

HORSE-POWER, the power of a horse or its equivalent; the force with which a horse acts when drawing. The mode of ascertaining a horse's power is to find what weight he can raise and to what height in a given time, the horse being supposed to pull horizontally. From a variety of experiments of this sort it is found that a horse, at an average, can raise 160 lbs. weight at the velocity of 2½ miles per hour. The power of a horse exerted in this way is made the standard for estimating the power of a steam-engine. Thus we speak of an engine of 60 or 80 horse-power, each horse-power being estimated as equivalent to 33,000 lbs. raised one foot high per minute. Engineers differ widely in their estimate of the work a horse is able to execute. That given above is the estimate of Boulton and Watt based on the work of London dray-horses, but it is considered much too high, 17,400 foot-pounds per minute being generally considered nearer the truth. As it matters little, however, what standard be assumed, provided it be uniformly used, that of Watt has been generally adopted. The general rule for estimating the power of a steam-engine in terms of this unit is to multiply together the pressure in pounds on a square inch of the piston, the area of the piston in inches, the length of the stroke in feet, and the number of strokes per minute, the result divided by 33,000 will give the horse-power, deducting one-tenth for friction. As a horse can exert its full force only for about six hours a day, one horse-power of machinery is equal to that of 4.4 horses. Nominal or calculated horse-power is a term still used, but of little real value, from its being calculated on steam at a pressure much below the real power exerted. Sometimes the real, actual, or indicated horse-power exceeds the nominal by as much as three to one.

HORSE-RACING, a sport of ancient origin, having been practiced among the Greeks and Romans. The institution of horse-races in England belongs to a very remote period. The first regular horse-races, however, did not take place till the reign of James I. The prize then consisted of a gold or silver bell, whence we have the expression "to bear away the bell." The successors of James I. down to Queen Anne were all more or less attached to the sport. Under George I. horse-racing became more and more flourishing, and the sport continued to grow in importance during the remainder of the century. The two most celebrated horses of that period were Flying Childers (foaled in 1715) and Eclipse (foaled in 1764), which long had the reputation of being the fleetest horses that ever ran. The former ran four miles in 6 min. 48 sec., carrying 9 st. 2 lbs. The latter was never beaten. None of the English sovereigns was more devoted to horse-racing than George IV. Between 1784 and 1792, while yet Prince of Wales, he gained 185 prizes, including the Derby of 1788. Horse-racing was introduced into France from England, and during the reign of Louis XIV., and still more during that of Louis XV., was pursued with the otmost enthusiasm. The revolution put an end to it for a time, but the sport was revived by Napoleon. Horse-races, mostly upon the English model, have also been introduced into various other countries. The principal varieties of horse-racing are flat-racing, or racing on level ground; steeple-chasing, or racing over ground not specially prepared for the purpose; hurdle-racing, in which the horses have to leap over obstacles purposely placed in the way; and match trotting. This last kind of race is a very favorite one in America, where the best trotting horses are to be found, but in England it is not much practiced. Steeple-chases and hurdle-races take place in the winter months, the chief English event of the season being the Grand National steeple chase, run over a course of 4 miles 1000 yards at Aintree, near Liverpool. Formerly all races were what is called weight-for-age races, that is, a specified difference in weight was conceded by the older horses. But it was found that when races were conducted on this plan the best horses came to be known, and the inferior ones withdrew, not venturing to compete with them, so that the race resulted in a walk-over. Hence arose the practice of handicapping, that is, of adjusting as nearly as possible the weight to be carried to the previously ascertained powers of the horse, so as to reduce the chances of all the horses entered to an exact equality. Since the introduction of this practice handicap races have become a very favorite sport. The breeding of thoroughbred horses is often a very profitable business. The pedigrees of all thoroughbred horses are registered in the stud-book, so that if any particular animal is omitted in that register the inference is that its pedigree is not without some blemish more or less remote.

In the United States horse-racing is now a national sport. Morris Park, in Westchester Co., N. Y., and Brighton Beach fairgrounds at Coney Island furnish good race-courses. The trotting-horse of America is really a distinct variety of the equine race. The best American trotters are descended from an imported English horse, Messenger. Remarkable running time, one mile in one minute 35½ seconds, was made by "Salvator," Monmouth Park, in 1890 in heat racing one mile was made by "Guido." in one minute 41¼ seconds Washington Park, Chicago, in 1891; at Memphis in 1905 "Lou Dillon" trotted a mile in one minute and 58½ seconds; the

best pacing time for one mile at St. Paul, Minn., by "Dan Patch" in one minute and 55 seconds.

HORSE-RADISH, a plant inhabiting the temperate parts of America in moist situations. The root is cylindrical, whitish in color, and forms a well-known condiment, possessing a pungent taste and odor. It is also employed medicinally, as a stomachic, diaphoretic, and diuretic, and externally as a rubefacient.

HORSE-SHOE, a shoe for horses, consisting commonly of a narrow plate of iron bent into a form somewhat resembling the letter U, so as to accommodate itself to the shape of the horse's foot. Horse-shoes do not appear to have been known to the ancients. Xenophon, Vegetius, and others mention various processes for hardening the hoofs so as to make them stronger, but say nothing of any protection like the horse-shoe. Iron horse-shoes are mentioned as being in use in Europe in the 9th century of our era, They seem to have been introduced into England by the Normans.

HORSE-TAIL, among the Turks and other Eastern nations, the tail of a horse mounted on a lance, and used as a standard of rank and honor. The three

Horse-tail standard of Pasha.

grades of pashas are distinguished by the number of tails borne on their standards, three being allotted to the highest dignitaries or viziers, two to the governors of the more important provinces, and one to those of less important districts.

HORTENSE, Eugenie de Beauharnais. See under Beauharnais.

HORTENSIUS, Quintus, Roman orator, born of an equestrian family, B.C. 114, died B.C. 50. His speeches are all lost.

HORTICULTURE, or **GARDENING,** includes, in its most extensive signification, the cultivation of esculent vegetables, fruits, and ornamental plants. In large gardens there are generally separate departments for flowers, fruits, and vegetables; but in small gardens they are usually more or less combined. A garden should be either on a level, but admitting of effectual drainage, or on a gentle slope, preferably on the lower portion of a slope facing the sun. It should be well sheltered, either naturally from situation, or artistically by means of plantations, walls, etc. The character of the soil is of much importance. A good loam, or a sandy loam mixed with humus, is the best. The former is better fitted for fruit-trees, but for early crops the sandy loam is desirable. While the greater part of a garden should consist of such soil, either naturally or artificially formed, it is useful to have a portion stronger and another much lighter in order to suit the requirements of different plants. The nature of the subsoil is also important. The best is a dry bed of clay overlying sandstone. Digging, plowing, and pulverizing the soil, and exposing the surface to the action of the summer sun and the winter's frost are highly useful operations, by which the tenacity of stiff soils is overcome, weeds and insects are destroyed, and a quantity of air is admitted into the ground. Nutritive matter is frequently supplied to plants in the form of manure, either organic or inorganic. After the soil is properly dry and pulverized, the seeds are deposited, and this should always be done in dry weather, for a dry soil is especially requisite for covering in the seeds. Watering is often necessary as a means of nourishment to growing plants, especially as a support to newly transplanted vegetables, and for cleaning the leaves and destroying insects. The methods of propogating plants are various. For an account of the processes of budding and grafting see these articles. Another mode of propagation is that by means of cuttings, or shoots cut off and planted in the soil, where they take root. This process is exceedingly simple and easy in the case of many trees, as the willows and poplars; but requires some management in the heaths, myrtles, and other shrubs. In growing ornamental plants and flowers and exotic fruits, plant-houses of various kinds are necessary. These comprise the numerous forms of conservatory, plant-stove, green-house, pits, and frames. Horticultural tools, instruments, implements, and machinery are very various.

HORUS, the Latinized form of Har, the day, or the sun's path, an Egyptian divinity. Two gods were latterly recognized under the name. The elder Horus was the son of Seb (identified by the Greeks with Kronos) and Nu (Rhea) and brother of Osiris. The other Horus was the son of Osiris and Isis, and is supposed to have come into the world soon after the birth of his parents. On the death of Osiris he was his avenger, defeating the serpent Typho, and enabling Isis to thwart his wicked designs. Both the elder and younger Horus were regarded as symbols of the sun.

HO'SEA, the first in order among the minor prophets of the Old Testament, but probably the third in order of time, flourishing about 750 B.C. Nothing is known of his life, except that he was the son of Beeri, and that his ministry belonged to the reigns of Uzziah, Jotham, Ahaz and Hezekiah, kings of Judah. The nation generally and the ten tribes in particular are reproved, exhorted, and threatened in his prophecy. He predicts the approaching exile of his countrymen, and the consoling promise of the final return of an improved people

HOSHANGABAD, chief town and headquarters of district of the same name, Central Provinces of India, on the Nerbudda. It is a chief seat of the British piece-goods trade, and does business in cotton, grain, etc Pop. 13,500. The district has an area of 4437 sq. miles, and a pop. of 529,945.

HOSHIARPUR, chief town and seat of administration of district of same name, Punjab, India. Pop. 21,552. The district has an area of 2244 sq. miles, and a pop. of 1,011,659.

HOSIERY, a general term for all kinds of knitted articles, including drawers, petticoats, night-dresses, etc., and fancy articles such as head-dresses, hoods, shawls, neckerchiefs, watch-guards, cravats, etc. The materials used for the purpose are cotton, linen, and wool, the last of which is sometimes mixed with cotton or silk. Silk is also frequently used alone. Nearly all articles of hosiery, except some fancy articles, are now made by a knitting-frame of some kind or other.

HOSPICE, signifies either a little convent belonging to a religious order, occupied by a few monks, and destined to receive and entertain traveling monks; or houses of refuge and entertainment for travelers on some difficult road or pass, as the Hospice of the Great St. Bernard.

HOSPITAL, any building appropriated for the reception of any class of persons who are unable to supply their own wants, and are more or less dependent upon public help to have those wants supplied. Hence hospitals are of various kinds, according to the nature of the wants they supply and the class of persons for whom they are intended. A large number of hospitals are medical; others are for the reception of incurables; others for the aged and infirm; others for the education of children of people in reduced circumstances; others for the reception of the wounded in battle; and so on. The first establishments of this nature are believed to belong to the 4th century after Christ. Their primary object was to afford a shelter to strangers and travelers, and it was only occasionally that the sick and infirm were admitted. One of the earliest hospitals of which we have any satisfactory information was that established by the emperor Valens at Cæsarea about the end of the 4th century, and which was conducted on a very large scale. The Arabs in Spain, at an early period of their occupation of that country, founded a magnificent hospital at Cordova, where physicians were trained, who did a vast deal to advance the study of medicine. The Arabs have also the credit of having founded the first lunatic asylum in Europe, which was erected in the city of Granada. The majority of hospitals everywhere are medical, often called infirmaries. These may be divided into general and special hospitals, the former class admitting cases of all kinds; the latter class admitting only patients suffering from some special trouble. Thus there are lying-in hosiptals, cancer, consumption, ophthalmic, lock (for venereal diseases), fever, and small-pox hospitals. There are also hospitals for children, and for persons suffering from incurable diseases. Such institutions serve a double purpose, inasmuch as they not only afford the best medical

advice and treatment to the poor, who would otherwise be unable to obtain it, but also supply the best means of giving instruction in medicine and surgery, as in them students have the opportunity of witnessing cases of nearly every variety of disease, and observing how they are treated by the most skilled physicians and surgeons. For this reason a good infirmary or medical hospital is an indispensable adjunct to every school of medicine and surgery. Hospitals for the sick and hurt are usually divided into wards, each containing a larger or smaller number of beds. Medical and surgical wards are usually kept separate, and all contagious diseases are treated by themselves in distinct buildings. Each hospital has a matron, house surgeon, and apothecary resident within its walls. The duties of the matron consist in regulating the night and day nurses, and the washing and laundry department, as well as the purchase of the necessary supplies of provisions, and keeping a general superintendence over the kitchen and messes of the sick. The house surgeon takes care of all casualties and accidents in the absence of the principal surgeons. The apothecary takes care of the pharmacy and prepares all the medicines prescribed from time to time by the surgeons and physicians. There is a well-lighted room set apart for the performance of operations, and a mortuary for the reception of corpses previous to interment. The nurses relieve each other day and night in a regular manner. Particular wards are set aside for the reception of persons laboring under various and peculiar denominations of disease.

Military and Naval Hospitals, or establishments for the reception and care of sick and wounded soldiers and seamen, have been in existence in all civilized countries for a long period. Military hospitals are either permanent or temporary establishments.

HOSPITAL FEVER, a malignant form of typhus fever, so called from its being most frequently met with in military and other large hospitals. See Typhus Fever.

HOSPITALLERS, charitable brotherhoods who devote themselves to tend the sick in hospitals. The name is specially applied to an order of knights, the Knights of St. John. See John, Knights of St.

HOST, a term used for the bread (or wafer) and wine in the eucharist, as containing the body and blood of Christ. As the wafer alone is given to laymen in the Roman Catholic church, as containing both the body and blood of the Redeemer, the term host is usually applied to the consecrated wafer. See Elevation, Mass.

HOSTAGE a person left as a pledge or surety for the performance of the articles or conditions of a treaty. The taking or giving of hostages is now scarcely known in the relations of modern communities, but was formerly almost universal, and many questions in the law of nations arose out of the practice. If the stipulated terms were observed the hostages were returned on each side, but if the terms were violated or evaded the hostages might be put to death.

HOT-BED, in gardening, a bed of earth heated by fermenting substances, such as fresh stable dung, tanners' bark, leaves of trees, etc., and covered with glass to defend it from the cold air, intended for raising early plants, or for nourishing exotic plants of warm climates, which will not thrive in cool or temperate air.

HOTCH'KISS, Benjamin Berkely, American inventor, born in Watertown, Conn., in 1826. During the civil war he was engaged in the manufacture of ordnance in New York, and later invented the Hotchkiss magazine gun, used by the United States troops in the west and the United States marine corps. This was followed in 1882 by the Hotchkiss machine gun, for use in the fighting tops of war-vessels. He was also the inventor of several important improvements in projectiles and heavy ordnance. His guns were in general use throughout the armies and navies of the world until displaced in the more advanced nations by later inventions. He died in 1885.

HOTHOUSE, a building for the cultivation of plants too delicate to grow in the open air. It is built chiefly of glass, and resembles a greenhouse in its structure, and arrangements except that artificial heat is kept up all the year round. Some are heated by steam, others by hot water in tubes, and others by the introduction of hot air.

HOT SPRINGS, the county-seat of Garland co., Ark., 50 miles west by south of Little Rock. It is widely noted for the hot waters that flow from 72 springs, including a space of 10 acres on the west side of Hot Springs Mountain. The waters of these springs range in temperature from 76° to 157° Fahr., and are beneficial in a multitude of diseases. In 1832 four sections of land, the thermal springs being in the center of the district, were set off by congress as a government reservation. Since then the government has established on the mountain the Army and Navy general hospital, and expended large sums in improving and developing the reservation. It has over 100,000 visitors annually. Pop. 11,800.

HOT'TENTOTS, peculiar African race, supposed to be the aboriginal occupants of the south end of that continent, at and near the Cape of Good Hope. Their limits may be said to have been the river Orange on the north and northeast, and the Kei on the east. When young they are of remarkable symmetry; but their faces are ugly, and this ugliness increases with age. The complexion is a pale olive, the cheek-bones project, the chin is narrow and pointed, and the face consequently is triangular. The lips are thick, the nose flat, the nostrils wide, the hair woolly, and the beard scanty. When the Dutch first settled at the Cape in the middle of the 17th century the Hottentots were a numerous nation, of pastoral and partially nomadic habits, and occupied a territory of 100,000 square miles. At the present day this race is nearly extinct within the wide territory which formerly belonged to it, having been entirely hunted out and dispersed by the Boers.

HOUND, a name given generally to hunting dogs; but restricted by scientific writers to such as hunt by scent, a definition which excludes the greyhound. Among the varieties are the bloodhound,

Deer-hound.

deerhound, foxhound, harrier, and beagle. Hounds are distinguished not only by their fineness of scent, but by docility and sagacity. Of the rough-haired and smooth-haired varieties the former manifest the greatest affection for man.

HOU-PE, HU-PEH, or **HOO-PE,** (North of the Lakes), a central province of China. It is intersected by the Han-kiang and the Yang-tse-kiang, and is considered one of the most fertile parts of the empire. Pop. 33,365,005.

HOUR, the twenty-fourth part of a day. In most countries the hours are counted from midnight to mid-day, and twelve hours are twice reckoned. But in some parts of Italy twenty-four hours are counted, beginning with sunset, so that noon and midnight are every day at different hours. Each hour is divided into sixty minutes, and each minute into sixty seconds.

HOUR-GLASS, an instrument for measuring time, consisting usually of two hollow bulbs placed one above the other, and having a narrow neck of communication through which a certain quantity of dry sand, water or mercury is allowed to run from the upper to the lower bulb, the quantity of sand being adjusted so as to occupy an hour in passing from one bulb to the other. The hour-glass was commonly used in churches during the 16th and 17th centuries to regulate the length of the sermon.

HOURIS (hou'riz or hō'riz), the "black-eyed" nymphs of Paradise, whose company, according to the Koran, is to be one of the rewards of the faithful. They are described as most beautiful virgins, endowed with perpetual youth, and subject to no impurity. They dwell in beautiful gardens, by flowing streams, and the very meanest of the faithful will have at least seventy-two of them.

HOUSE, in point of law the common expression, "an Englishman's house is his castle," is in most instances true. Except where there has been a criminal offense, an Englishman can hold his house against all comers. No bailiff can break open his door to arrest him, or seize his goods for debt, nor can any court give him this power; but if a bailiff is once permitted to enter he cannot be expelled. The same conditions govern in the United States.

HOUSE-BREAKING. See Burglary.

HOUSE-FLY. See Fly.

HOUSEHOLD GODS, among the Romans, deities known as the Lares and Penates, and presiding over the fortunes of the house or family.

HOUSEMAID'S KNEE, an acute inflammation of the bursa or sac between the kneepan and the skin, so called because it is common among housemaids from their kneeling on hard damp stones. It is treated like other local inflammations by fomentations, and if necessary leeches. Mild purgatives are also useful, and the limb ought to have complete rest.

HOUSE OF COMMONS. See Britain—section Parliament.

HOUSE OF CORRECTION, a prison for idle and disorderly persons, and certain classes of criminals, such as prisoners convicted of felony or misdemeanor, vagrancy, etc., or committed on charge of such. Originally vagrants, trespassers, and convicted persons were detained in these houses that they might be compelled to work. They are sometimes called bridewells.

HOUSE OF LORDS. See Britain; also Parliament.

HOUSTON, a town in Texas, capital of Harris co., at the head of steamboat navigation on Buffalo bayou, 48 miles northwest of the important seaport of

Galveston, and the great railway center of the state. It stands in an excellent grazing district, and contains iron-foundries, cotton-presses, machine-shops and other industrial establishments. It is a great shipping port for cotton. Pop. 1909, estimated at about 90,000.

HOUSTON, Samuel, American general and president of the Republic of Texas, was born in Lexington, Va., in 1793. When quite young he moved to Tennessee. A part of his youth was spent among the Cherokee Indians, by whom he was named "Colonel." In 1813 he enlisted in the United States army, and while serving under General Jackson, was wounded in an engagement with the Creek Indians. He studied law in Nashville, Tenn., and served his state in congress from 1823–1827, when he became governor of the state. His marriage in 1829 was unfortunate; he separated from his wife, and went to live among the Arkansas Indians, and was sent to Washington to represent their interests. He visited Texas in 1832, and accepted the invitation to take up his residence there, and to become leader of the colonists in the struggle for their rights. The Texans sought union with the United States, but were denied. Santa Anna demanded that they surrender their arms, which they refused to do. Houston became commander-in-chief of the army organized to oppose the demand of Mexico. Santa Anna was captured in the battle of San Jacinto, April, 1836, and the independence of Texas secured. General Houston was the first president of the Republic of Texas. On the admission of Texas to the union, Houston represented the state as senator for twelve years. When the civil war broke out, he opposed secession and was compelled to leave Texas. He was of fine presence and a natural orator. He died in 1863.

HOWARD, Oliver Otis, American soldier, was born in Leeds, Maine in 1830. In 1861 he became colonel of the Third Maine volunteers, and commanded a brigade in the first battle of Bull Run. He took a prominent part in the battle of Antietam; was promoted to be major-general of volunteers in November; and was engaged in the battle of Fredericksburg. In April, 1863, he was placed in command of the Eleventh army corps, and as such took a conspicuous part in the battles of Chancellorsville and Gettysburg. In December, 1864, he was appointed brigadier-general in the regular army, and in March, 1865, was brevetted major-general for services at Ezra Church and during the Atlanta campaign. In 1874 Howard was placed in command of the Department of the Columbia, and in this capacity conducted the operations against the Nez Percés Indians in 1877, and against the Bannocks in 1878. In 1886 he was appointed major-general in the regular army, and in November, 1894, retired from the service.

HOWE, Elias, an American inventor, was born in Spencer, Massachusetts, in 1819, died at Brooklyn in 1867. He constructed a sewing-machine in 1846, and was for several years involved in expensive and harassing lawsuits to establish his right to reap the benefits of his own ingenuity. Immense numbers of the Howe sewing-machine are now manufactured and sold in America, Great Britain, and elsewhere.

HOWE, Julia Ward, American poet and sociological writer, was born in New York in 1819. She edited with her husband, Dr. S. G. Howe, the Boston Commonwealth, an anti-slavery journal. After the war she became a noted advocate of female suffrage. She is best known by her immensely popular Battle Hymn of the Republic, which was written in 1861.

HOWE, Richard, Earl Howe, English admiral, was the second son of Emanuel Scrope, second Viscount Howe, and was born in 1725, died 1799. In 1783 he accepted the post of first lord of the admiralty, which, with a partial intermission, he continued to hold until 1793, when, on the breaking out of the war with France, he took the command of the British fleet, and bringing the enemy to an action on June 1, 1794, he obtained over them a decisive victory, for which he received the thanks of parliament and other honors. In 1797 Lord Howe exerted himself with great success to quell the mutiny among the seamen at Portsmouth.

Lord Howe.

HOWE, Samuel Gridley, American philanthropist, was born in Boston in 1801. He served with the Greeks in their struggle for freedom and took part in the July revolution in Paris. He then became interested in the education of the blind, the subject which his name will be longest connected, and the Perkins institute in Boston became the greatest school of its kind in the world. He was the inventor of many improvements in method as well as in the processes of printing books in raised types. At the Perkins institute his most remarkable achievement was in the education of Laura Bridgman. During the civil war he was one of the directors of the sanitary commission. He was the originator of the state board of charities of Massachusetts in 1863, the first board of the sort in America. He died in 1876.

HOWE, Sir William, British soldier, was born in 1729. He was a younger brother of Richard, Earl Howe, whom he succeeded as fifth Viscount Howe in 1799. In 1757, he was placed in command of the Fifty-eighth Foot, and sent with it to America, where he took part in the siege and capture of Louisburg and accompanied Wolfe on his expedition to Quebec. He commanded the reënforcements sent to General Gage at Boston in March, 1775. He commanded the British in the battle of Bunker Hill,

General Sir William Howe.

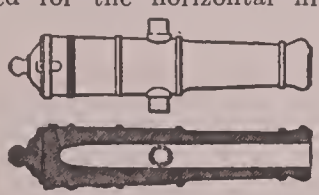
on June 17th following. He succeeded Gage in command of all the troops in America outside of Canada, with the local rank of general. Besieged in Boston by Washington during the winter of 1775–76, and, being compelled to abandon the city, he withdrew his troops to Halifax, and afterward transferred his command to Staten Island, whence he moved on New York, winning the battle of Long Island on August 27, 1776, and occupying the city on September 15th. On October 28th he defeated Washington at White Plains, and

afterward captured Forts Washington and Lee. He defeated Washington at the Brandywine on September 11th, and on September 27th occupied Philadelphia. Howe sent in his resignation shortly after taking Philadelphia, and Sir Henry Clinton was appointed to succeed him. In 1782 he became lieutenant-general of ordnance, and attained the rank of full general in the following year. He died in 1814.

HOWELLS, William Dean, an American novelist, born at Martinsville, Ohio, in 1837. He learned the printer's trade with his father; was afterward assistant editor on the Ohio State Journal; published a life of Abraham Lincoln and a

volume of poems; was appointed in 1861 United States consul at Venice. On his return to America in 1865 he joined the staff of the Nation, became afterward editor of the Atlantic Monthly (1871–81), but made himself known chiefly as a writer of novels. Among his works are Venetian Life, Italian Journeys, A Chance Acquaintance, A Foregone Conclusion, The Lady of the Aroostook, Dr. Breen's Practice, A Modern Instance, The Rise of Silas Lapham, Indian Summer, The Flight of Pony Baker, The Kentons, ets.

HOWITZER, a short piece of ordnance, usually having a chamber for the powder narrower than the bore, specially designed for the horizontal firing of



Brass howitzer (24 pounder).

shells with small charges, combining in some degree the accuracy of the cannon with the caliber of the mortar, but much lighter than any gun of the same capacity. The rifled gun, throwing a shell of the same capacity from a smaller bore, and with much greater power, has superseded the howitzer for general purposes.

HOWLER MONKEY, a genus of South American monkeys, characterized by a remarkable loudness of voice, which is

Howler.

due to the presence of a large chamber within the hyoid bone and the enlargement of the ventricles of the larynx. In the tropical forests of America their hideous howls, probably a kind of amorous concert, may be heard during the night more than a mile away. They are prehensile-tailed, large, and heavy of body, with a high pyramidal head flattened on the summit.

HOWRAH, a town of India, on the right bank of the Hugli, opposite Calcutta, of which it is practically a suburb, and with which it communicates by a floating bridge. It has large dockyards, jute and saw mills, and various manufactories. Pop. 157,594.

HUCKLEBERRY, an American name for the whortleberry, which see.

HUDDERSFIELD, a flourishing manufacturing town, in the West Riding of Yorkshire, England, 16½ miles southwest of Leeds, The plan of the town is very regular, and the houses are well though somewhat uniformly built. Some of the public buildings are elegant structures. Among its institutions are two colleges for higher education, a technical school, etc. The town is the chief center of the fancy woolen trade. Broadcloths, doeskins, trouserings are also manufactured, and there are manufactories of steam-engines, machinery, etc. Pop. 95,056.

HUDSON, a town and port, in the state of and 116 miles north of New York, on the left bank of the Hudson. It is regularly built, and has large iron-smelting works, foundries, breweries, etc. Pop. 13,374.

HUDSON, Henry, English navigator date of birth unknown. He sailed from London in the year 1607 in a small vessel with only ten men and a boy, to discover the Northeast Passage, and proceeded beyond the 80th degree of latitude. In a second voyage he landed at Nova Zembla, but could get no further eastward. In 1609 he sailed for North America, and discovered the Hudson river, which he ascended about 50 leagues. In 1610 he sailed in an English ship named the Discovery, and discovered Hudson Strait and Hudson's Bay, where he wintered; but his crew, after suffering many hardships, mutinied and set him adrift in a boat along with his son John and seven of the most infirm of the crew, none of whom were ever again heard of. Hudson published Divers Voyages and Northern Discoveries (1607), and a Second Voyage (1608).

HUDSON BAY, or **HUDSON'S BAY,** an extensive bay, or rather an inland sea, Dominion of Canada, extending between lat. 51° and 64° n., and lon. 77° and 95° w.; length, north to south, about 800 miles; greatest breadth, about 600 miles. Hudson bay is navigable for 4½ months in summer (from middle of June to end of October), being obstructed by drift-ice during the rest of the year. There are many islands, reefs, and sandbanks. The shores on the east are high and bold; but those on the west, especially toward the south, are low and level, and much of the land here is favorable for stock and dairy farming. The white whale is found in its waters, and there is a considerable summer fishery.

HUDSON RIVER, a river in the United States. It rises, by two branches, in the northern part of the state of New York, in the Adirondack mountains, about lat. 44° n. Two small streams unite to form the river, which is afterward joined by the Schroon and Sacondaga. At Glen's Falls it has a fall of 50 feet, after which it runs almost due south to its mouth in New York bay. Its whole course is over 300 miles; it is navigable as far as Hudson, 118 miles, for the largest vessels. The banks of the Upper Hudson are high and rocky; and the scenery very picturesque.

HUDSON'S BAY COMPANY, an English trading company, chartered May 2,1670. It had long a monopoly of the trade throughout the whole territory of North America whose streams flow into Hudson's Bay, and at one time as far westward as the Pacific, with rights of governing and making war. In 1870 its authority was transferred by act of paliament to the crown, and its territories incorporated in the Dominion of Canada. Its trade in furs is still very large.

HUE AND CRY, in English law, the pursuit of a felon or offender, with loud outcries or clamor to give an alarm. This procedure is taken by a person robbed, or otherwise injured, to pursue and get possession of the culprit's person. At common law, a private person who has been robbed, or who knows that a felony is committed, is bound to raise a hue and cry under pain of fine and imprisonment. This is generally done by informing the nearest constable; and this process is still recognized by the law of England as a means of arresting felons without the warrant of a justice of the peace. The same name is also applied to a paper circulated by the secretary of state for the home department announcing the perpetration of offenses.

HUELVA, a seaport town of Southwestern Spain, capital of the province of same name in Andalusia. It has wide and well-built streets. There are manufactures of matting, ropes, sails, etc., a large trade in the exportation of copper ore; also in fruits and wine. The fisheries, mainly sardine and tunny, are of considerable value. Pop. 19,686.—The

province of Huelva is mountainous and well wooded in the north, and contains celebrated copper mines. In the south

it is comparatively level, and has a rich alluvial soil. Pop. 253,970.

HUG'GINS, Sir William, English astronomer, was born in London in 1824. In 1856 he built an observatory in which he mounted a telescope of eight-inch aperture, and made careful drawings of Mars, Jupiter, and Saturn. His attention was engaged in observations of spectrum analysis. His first discovery in this line was presented to the Royal society in a paper on the Lines of Some of the Fixed Stars.

He introduced photography into astronomy, which, enabled the astronomer by long exposure to obtain good pictures of celestial objects, too faint to be seen even with the most powerful telescope. Huggins also invented a spectroscopic method for studying the red prominences of the sun, and proved, through a laboratory experiment, the existence of calcium in the solar prominences and chromosphere. He was president of the Royal astronomical society from 1876 to 1878, of the British association for the advancement of science in 1891. He was chosen president of the royal society in 1900, and has at different times received the Royal, the Copley and Rumford medals.

HUGHES, CHARLES EVANS, born Apr. 11, 1862, Glen Falls, N. Y., where his father was Baptist pastor. He graduated from Brown Univ. and Columbia Law School; was prof. of law Cornell Univ. 1891-3, lecturer 1893-95, and of N. Y. Law School from 1893; was counsel on the legislative investigations of life-insurance companies 1905, elected Governor of New York State 1906.

HUGHES, Thomas, an English barrister, author, and philanthropist, born, at Uffington, Berkshire, in 1823. He is widely known by his novel, Tom Brown's School-days, a picture of school life at Rugby, published in 1856. It was followed by Tom Brown at Oxford (1861), A Layman's Faith (1868), Alfred the Great (1869), The Manliness of Christ, and other writings. He was one who devoted much time to the social elevation of the working-class, encouraging in particular the co-operative system. In 1865–68 he was member of parliament for Lambeth, and in 1868–74 for Frome. He was latterly a county-court judge. In 1880 he took a prominent part in the socialistic settlement at Rugby, Tenn. He died in 1896.

HUGLI, or **HOOGHLY** (hōg'li), a river of Hindustan, in Bengal, formed by the junction of the Bhagirathi and the Jalangi at Nadija, about 55 miles above Calcutta. Ships drawing 26 feet ascend as far as Calcutta.

HUGO (ü-gō), Victor Marie, a French poet and novelist, born February 26, 1802, at Besançon, where his father, then Major Hugo, was stationed in command of a brigade. At the age of twelve he was already writing verses, and in 1823 his first novel, Han d'Islande, appeared, followed in 1825 by Bug Jargal. In 1828 a complete edition of his Odes et Ballades appeared. After the coup d'état, December 2, 1851, he was one of those who kept up the struggle in the streets against Napoleon to the last. He then fled to Brussels, where he published the first of his bitter satires on the founder of the second empire, Napoléon le Petit. In the following year (1853) the second, the famous volume of Les Châtiments, a wonderful mixture of satirical invective, lyrical passion and pathos appeared. Hugo now went to live in Jersey, was expelled along with the

Victor Hugo.

other French exiles in 1855 by the English government, and finally settled in Guernsey. It was in the comparative solitude and quietness of the Channel islands that he wrote most of the great works of his later years, Les Contemplations (1856), La Légende des Siècles, 1st series (1859), Chansons des Rues et des Bois (1865), and his celebrated series of social novels, Les Misérables (1862) Les Travailleurs de la Mer (1866), L'Homme qui Rit (1869). In 1870, after the fall of the empire, Victor Hugo returned to Paris, where he spent the remaining years of a remarkably vigorous old age in occasional attendances at the senate, and in adding to the already long list of his literary works. Among these latest productions we may mention Quatre-vingt-treize (1872), L'Art d'Etre Grand-père (1877), L'Histoire d'un Crime (1877), Le Pape (1878), La Pitie Suprême (1879), Religions et Religion (1880), Les Quatre Vents de l'Esprit (1881), La Légende des Siècles (last series 1883), Torquemada (1882). He died on May 2, 1885.

HUGUENOT SOCIETY OF AMERICA, The, an hereditary patriotic society, organized in New York City on April 12, 1883, and incorporated on June 12, 1885. Its objects are to perpetuate the memory and to foster and promote the principles and virtues of the Huguenots; to publicly commemorate at stated times the principal events in the history of the Huguenots; and to collect and preserve all existing documents, monuments etc., relating to the genealogy or history of the Huguenots of America. Membership is extended to descendants of Huguenot families which emigrated to America or to other countries prior to the promulgation of the Edict of Toleration, November 28, 1787, as well as to writers who have made the history of the Huguenots a special subject of study.

HUGUENOTS (hū'ge-nots), a term of unknown origin, applied by the Roman Catholics to the Protestants of France during the religious struggles of the 16th and 17th centuries. During the early part of the 16th century the doctrines of Calvin, notwithstanding the opposition of Francis I., spread widely in France. Under his successor Henry II., 1547–59, the Protestant party grew strong, and under Francis II. became a political force headed by the Bourbon family, especially the King of Navarre and the Prince of Condé. At the head of the Catholic party stood the Guises, and through their influence with the weak, young king, a fanatical persecution of the Huguenots commenced. The result was that a Huguenot conspiracy, headed by Prince Louis of Condé, was formed for the purpose of compelling the king to dismiss the Guises and accept the Prince of Condé as regent of the realm. But the plot was betrayed and many of the Huguenots were executed or imprisoned. In 1560 Francis died, and during the minority of the next king, Charles IX., it was the policy of the queen mother, Catharine de Medici, to encourage the Protestants in the free exercise of their religion in order to curb the Guises. But in 1562 an attack on a Protestant meeting made by the followers of the Duke of Guise commenced a series of religious wars which desolated France almost to the end of the century. Catherine, however, began to fear that Protestantism might become a permanent power in the country, and suddenly making an alliance with the Guises between them they projected and carried out the massacre of St. Bartholomew's (August 25, 1572). The Protestants fled to their fortified towns and carried on a war with varying success. On the death of Charles IX., Henry III., a feeble sovereign, found himself compelled to unite with the King of Navarre, head of the house of Bourbon and heir-apparent of the French crown, against the ambitious Guises, who openly aimed at the throne, and had excited the people against him to such a degree that he was on the point of losing the crown. After the assassination of Henry III. the King of Navarre was obliged to maintain a severe struggle for the vacant throne; and not until he had, by the advice of Sully, embraced the Catholic religion (1593), did he enjoy quiet possession of the kingdom as

Henry IV. Five years afterward he secured to the Huguenots their civil rights by the Edict of Nantes, which confirmed to them the free exercise of their religion, and gave them equal claims with the Catholics to all offices and diginities. The Edict of Nantes was revoked in 1685, and by this act more than 500,000 Protestant subjects were driven out to carry their industry, wealth, and skill to other countries. In the reign of Louis XV. a new edict was issued repressive of Protestantism, but so many voices were raised in favor of toleration that it had to be revoked. The revolution first put the Protestants on an equality with their Catholic neighbors.

HULK, the name applied to old ships laid by as unfit for further sea-going service, and used as depôts for coals, sailors, etc. The hulks formerly often heard of in England consisted of old ships to which convicts were sent previously to their transportation.

HULL, Isaac, American marine officer, was born at Derby, Conn., in 1773. While on his way from Annapolis to New York, by masterly seamanship he escaped from a squadron of five British men of war that pursued him for several days. His celebrated victory over the Guerriere, a slightly weaker British frigate, which was forced to surrender, was the first victory obtained by the Americans over the British in the war and aroused great enthusiasm. He is regarded as the ablest single ship commander on either side during the war of 1812. He died in 1843.

HULL, or **KINGSTON-ON-HULL,** a river port, municipal and parliamentary borough of England, and a county of itself, locally situated in the East Riding of York at the influx of the Hull into the estuary of the Humber. Pop. 240,618.

HUMANE ASSOCIATION, American federation of societies of the United States for the prevention of cruelty to animals and children, was formed at Cleveland, Ohio, in 1877. It investigated the abuses which prevailed on lines of railways transporting cattle, and offered a prize of $5000 for the best model of a cattle-car that would make possible the feeding, watering, and resting of cattle in transit, the result of which was that many improved cars were brought into use.

HUMANITA'RIANS, a term sometimes applied to the various classes of anti-trinitarians, who regard Christ as a mere man. Their opinions must not be confounded with Arianism, which admits the pre-existence of Christ, and his pre-eminence among God's creatures. The term is also applied to the followers of St. Simon, who maintained the perfectibility of human nature without the aid of supernatural grace.

HUMANITIES, a term for humane or polite literature, including the study of the ancient classics, in opposition to philosophy and science. In the Scotch universities humanity is applied to the study of the Latin language and literature alone.

HUMBER, a large river, or rather estuary, on the east side of England, between the counties of York and Lincoln.

HUMBERT I., Umberto, King of Italy, born March 14, 1844, eldest son of Victor Emmanuel. In the war of 1866, in which Italy joined Prussia against Austria, he took the field in command of a division, and distinguished himself by his bravery in the disastrous battle of Custozza. In 1868 he married his cousin, Margherita, daughter of Duke Ferdinand of Genoa. He succeeded his father on January 9, 1878, and was assassinated in July, 1900.

HUMBOLDT (hum'bolt), Friedrich Heinrich Alexander, Baron von, a German traveler and naturalist, was born September 14, 1769, at Berlin. In 1797 he resolved to make a scientific journey in the tropical zones along with a friend, Aimé Bonpland. They landed at Cumana, in South America, in July, 1799, and spent five years in exploring scientifically the region of the Orinoco and the upper part of the Rio Negro, the district between Quito and Lima, the city of Mexico, and the surrounding country, and the island of Cuba. In 1829, under the patronage of the Czar Nicholas, he made an expedition to Siberia and Central Asia, which resulted in some valuable discoveries, published in his Asie Centrale. Humboldt died in 1859.

HUME, David, an eminent historian and philosopher, was born at Edinburgh on the 26th April, 1711. We was destined for the law, but was drawn away

David Hume.

by his love of literature and philosophy; and retired to France, where during three years of quiet and studious life he composed his Treatise upon Human Nature. The work was published at London in 1738, but, in his own words, "fell dead-born from the press." His next work, Essays, Moral, Political, and Literary (Edinburgh, 1742), met with a better reception. In 1745 he became companion to the insane Marquis of Annandale; and he accompanied General Sinclair in 1746 and 1747 in his expedition against France and in a military embassy to Vienna and Turin. He now published a recasting of his Treatise upon Human Nature, under the title of an Inquiry Concerning the Human Understanding (1747). In 1752 he published his Political Discourses, which were well received, and his Inquiry Concerning the Principles of Morals. The same year he obtained the appointment of librarian of the Advocates' library at Edinburgh, and began to write his History of England, of which the first volume appeared in 1754. In 1767 he was appointed under-secretary of state, a post which he held till 1769, when he retired to Edinburgh. Here he lived till his death on August 25, 1776.

HUMMING-BIRDS, the name given to a family of minute and beautiful birds, so called from the sound of their wings in flight. The beak is slender, generally long, sometimes straight and sometimes

Tufted-necked humming-bird.

curved; the tongue is long, filiform, bified at the point, and capable of being protruded to a considerable distance. In size humming-birds vary from that of a wren to that of a bumble-bee. They never light to take food, but feed while on the wing, hovering before a flower, supported by a rapid vibratory movement of the wings which produces the humming noise. Insects form a great proportion of their food. These beautiful birds are peculiar to America, and almost exclusively tropical. One species the ruby-throated humming-bird, is pretty common in the northeast of the United States. The only note of the humming-bird is a single chirp, not louder than that of a cricket. It is very fearless and irascible, two males scarcely ever meeting without a contest. Among the more remarkable of these birds is the tufted-necked humming-bird of Guiana and Northern Brazil. In this species the crest, outer tail-feathers, and neck-plumes are reddish chestnut, the latter tipped with green, the throat and upper part of the breast are emerald green, the back bronze green. Perhaps four hundred species of humming-birds are now known.

HUNGARY (Hungarian name, Magyar-Orszag, Land of the Magyars), a kingdom in the southeast of Europe, forming, together with Austria, the Austro-Hungarian monarchy. It includes Hungary Proper, with Transylvania, Slavonia, Croatia, the Croato-Slavonian Military Frontiers, etc.; total area, 124,400 sq. miles, with a pop. of 19,203,531. Hungary Proper (including Transylvania), with an area of 108,000 sq. miles and a pop. of 16,653,332, may be considered as a large basin surrounded by mountains on every side except the south. Of these the principal are the Carpathians, which cover the northern and eastern parts of the country with their ramifications. The Danube and the Theiss, with their affluents, are the chief rivers. Hungary is one of the healthiest countries in Europe, and generally has a fertile soil. All kinds of grain, especially wheat, wines, fruits,

tobacco, hemp, flax, hops, saffron, woad, madder, sumach, cotton, are among the products of Hungary. Horses, cattle, sheep, hogs, game (in the north bears), poultry, fish (especially the sturgeon and salmon), bees, and silk-worms are among the productions of the animal kingdom. Among the minerals are gold, silver, copper, iron, lead, zinc, cobalt, antimony, sulphur, arsenic, salt, etc., with coals and peat. The situation of Hungary, which occupies an area where the various races of Europe meet and interlace, accounts for the variety of nationalities it contains. These comprise, besides the Hungarians or Magyars (over 7,000,000 in number), Roumanians, Slavocks, Germans, Servians, Ruthenians, etc. The Magyars, who are the dominant race, are located for the most part compactly in the center of the kingdom. They are brave, high-spirited, and sincere, in many respects resembling their kinsmen the Turks. A decided majority are Roman Catholics, the rest Protestants, chiefly Calvinists, with a few Greek Catholics. The Germans have settled all over the country, and there is scarcely a town of Hungary which is not at least partly inhabited by Germans, while some are essentially German. Science, literature, the press, trade and industry, are for the greater part in their hands. The Hungarian has a natural inclination to agriculture and the breeding of cattle, and the fertility of the soil making up for some deficiencies in methods has made Hungary one of the chief corn-growing countries of Europe. It is also celebrated for its wines, the finest variety of which is the Tokay. There are few extensive manufactures in Hungary. Iron and steel works, potteries, glass manufactories, sugar-refineries, soap and tallow works, are amongst the principal. The production of coal and iron is increasing and the annual value of the mining products is about $12,500,000. With regard to popular education Hungary is behind the Austrian part of the empire, but education was made compulsory in 1868. There are universities at Budapest, Klausenburg, and Agram. The Hungarian language is nearly allied to the Turkish and Finnish, but not to any other tongue spoken in Europe. It has latterly been carefully cultivated, and Hungarians have distinguished themselves in all branches of literature. Among modern names we can only mention those of Andrew Horvath, Eötvös, A. and C. Kisfaludy, Garay, Vörösmarty, Petöfi, Kerény, Arany, Josika, and Jokay. Beside its representation in the controlling body of delegations (see Austria) Hungary since 1867 has an independent diet, consisting of an upper and lower house the first composed of hereditary and life peers, church dignitaries and state dignitaries; the second of representatives elected by vote. The Austrian emperor is only king of Hungary. Croatia and Slavonia have a common diet of their own for the management of internal affairs.

The Magyars, an Asiatic people of Turanian race, allied to the Finns and the Turks, dwelt in what is now Southern Russia before they descended under Arpad into the plain of the Danube, toward the end of the 9th century, and conquered the whole of Hungary and Transylvania. During the first half of the 10th century their invasions and incursions spread terror throughout Germany, France, and Italy; but at length their total defeat by Otho I. of Germany put an end to their maraudings, and under their native dynasty of Arpads they settled down to learn agriculture and the arts of peace. Stephen I. (997–1030) was the first who was successful in extending Christianity generally among the Hungarians, and was rewarded by a crown from Pope Sylvester II. and with the title of apostolic king (1000). In 1089 King Ladislaus extended the boundaries of Hungary by the conquest of Croatia and Slavonia, and King Coloman by that of Dalmatia in 1102. About the middle of the 13th century King Bela induced many Germans to settle in the country which had been depopulated by the Mongol invasions. With Andrew III. (1290–1301) the male line of the Arpad dynasty became extinct, and the royal dignity now became purely elective. Charles Robert of Anjou was the first elected (1309). Louis I. (1342–82) added Poland, Red Russia, Moldavia, and a part of Servia, to his kindgom. The reign of Sigismund (1387–1437), who was elected emperor of Germany, is interesting from the invasion of Hungary by the Turks (1391), and the war with the Hussites. Matthias Corvinus (1458–90), combining the talents of a diplomatist and general, is even yet remembered by the popular mind as the ideal of a just and firm ruler. During the reigns of Ladislaus II. (1490–1516) and Louis II. (1516–26) the rapacity of the magnates and domestic troubles brought the power of Hungary low, and the battle of Mohacs (1526) made a great part of the country a Turkish province for 160 years. The rest was left in dispute between Ferdinand of Austria and John Zapolya; but eventually by the help of the Protestants passed to the former, and has since remained under the scepter of the Hapsburgs. In 1686 Leopold I. took Buda and recovered most of Hungary and Transylvania. In 1724 Charles VI. secured by the Pragmatic Sanction the Hungarian crown to the female descendants of the House of Hapsburg, and the loyalty of the Hungarians to his daughter, Maria Theresa, saved the dynasty from ruin. Maria Theresa did much for the improvement of Hungary by the promulgation of the rural code called Urbarium, and by the formation of village schools. On the advent of the French revolution, and during the wars which ensued, the Hungarians once more played a prominent part in support of the Hapsburg crown. Napoleon fell, but the revolution had given an impetus to ideas of national and popular rights which the Hungarians, long stifled under the Germanic traditions and tendencies of their rulers, were among the first to feel. For a time Francis I. and Metternich stood stiffly out against all concessions, and tried to govern by pure absolutism, but ended by summoning in 1825 a new diet. The diet distinguished itself by adopting the Magyar language in its debates instead of the Latin to which it had been accustomed. Succeeding diets in 1830 and 1832 made new demands in the direction of religious equality, a popular suffrage, and abrogation of the privileges of the nobles. The Austrian government attempted to repress the Hungarian national movement by imprisoning Deak, Kossuth, and others of the leaders. The struggle continued till 1848, when the French revolution of that year gave the impulse for a similar rising in Vienna. Prince Metternich fled to London, and the Viennese court made a formal concession of all important demands; but these had no sooner been granted than the government began secretly to work against their being put in operation. The dependencies of the Hungarian crown, the Croats and the Wallachians of Transylvania were privately encouraged to revolt, and in December of the same year an Austrian army took the field with the avowed object of annihilating the independence of Hungary; but a series of pitched battles resulted on the whole so much in favor of the Hungarians that Austria was obliged to call in the aid of Russia, which was at once granted. After a heroic struggle the Hungarians had to succumb. The nation was reduced to the position of a province, and some of the greatest statesmen and soldiers of Hungary perished on the scaffold. But the struggle was continued by the Hungarians in the form of a constitutional agitation, and at last, when the battle of Sadowa in 1866 separated Austria from Germany, Austria, left face to face with a nation almost as powerful and numerous as itself, felt compelled to submit. In 1867 a separate constitution and administration for Hungary was decreed, and on 8th June the emperor and empress were crowned king and queen of Hungary with the utmost pomp, according to the ancient ceremonies of a Hungarian coronation. The dualism of the Austrian empire was thus finally constituted. It was indeed but the partial recognition of the fact that the empire was a heterogeneous assemblage of communities differing widely in race, language, social habits and customs, and bound together only by the accident of having fallen to the house of Hapsburg.

HUNGER, a craving for food. It is a sensation partly arising in the stomach, since it may be relieved temporarily by the introduction into the stomach of material which is incapable of yielding any nutriment to the body. It may be due to a condition of fulness of the vessels of the stomach, relieved by any stimulus which, acting on the lining membrane, induces a flow of fluid from the glands. But it also arises from a condition of the system since the introduction of nutriment into the blood, apart altogether from the stomach, will relieve it. This is also evident from the fact that hunger may be experienced even when the stomach is full of food, and when food is supplied in abundance, if some disease prevents the absorption of the nourishment, or quickly drains it from the blood. Hunger may be partially allayed by sleep or by the use of narcotics, tobacco, and alcohol, all of

which tend to diminish the disintegration of tissue.

HUNS, a nomadic and warlike people of Asia, of Mongolian race, part of whom entered Europe, probably in the 4th century after Christ, conquered the Alans, and drove the Goths out of Dacia. They continued to extend their dominion along the Danube till the time of Attila (434 A.D.), who, uniting the whole Hunnish power in one hand became the most powerful prince of his time. His defeat near Chalons was the commencement of the decline of the power of the Huns, and within a generation after his death in 453, the great Hunnish empire had completely disappeared, and the race been absorbed among other barbarous peoples. The term Huns was used by ancient and mediæval writers in a very vague way to indicate barbarous hordes invading Europe from the northeast. The Huns are described as a race of dark complexion with small black eyes, flat noses, and broad shoulders.

HUNT, James Henry Leigh, an English poet and essayist, born in 1784. Among his works may be mentioned, A Legend of Florence, a play represented with some success at Covent Garden in 1840; Stories from the Italian Poets (two vols. 1846); Men, Women, and Books (1847); A Jar of Honey from Mount Hybla (1847); the Town, its Memorable Characters and Events (1848); Autobiography (three vols.1850); Table Talk (1850). In 1842 Mrs. Shelley settled an annuity of $600 upon Leigh Hunt, and in 1847 a government pension of $1,000 a year was bestowed on him. He died in 1859.

HUNT, Richard Morris, American architect, was born at Brattleboro, Vt., in 1828. He was the architect of the capitol extension at Washington, the Lenox library, the Tribune building, New York, the United States naval observatory at Washington, the Divinity college building at Yale, the administration building for the World's Fair, Chicago, and the Yorktown monument. Among private houses by him are: W. K. Vanderbilt's, New York; the country house of George Vanderbilt, Biltmore, N. C.; and several beautiful summer houses at Newport, R. I., including the "Marble House" and the "Breakers." He was one of the founders, and in 1888 became president of, the Institute of Architects. He was a knight of the Legion of Honor and a foreign associate of the Institute of France. He died in 1895.

HUNT, William Holman, an English painter, born in 1827 at London. In 1853 his Claudio and Isabella first attracted public attention, followed next year by the Light of the World (Christ teaching in the temple). Outside of Biblical subjects Mr. Hunt has painted some notable pictures: Isabella and the Pot of Basil, The After-Glow, The Festival of St. Swithin, etc.

HUNTER, John, surgeon and physiologist, was born at Long Calderwood, Lanarkshire, in 1728. He died in 1793. Hunter contributed greatly to the high development of English surgery, as well as to the advance of anatomy.

HUNTER, Robert Mercer Taliaferro, American politician, born in Essex co., Va., in 1809. He was elected to the state legislature in 1833 and to congress in 1837, and was re-elected with the exception of the twenty-eighth congress (1843–45) until 1847, when he took his seat in the senate. He was expelled from the senate in 1861 after the secession of Virginia. From July, 1861, to February, 1862, he was secretary of state in Jefferson Davis' cabinet. He also represented Virginia in the Richmond senate 1862–65. He died in 1887.

W. Holman Hunt.

HUNTING DOG, this animal which inhabits all the more open parts of Africa south of the Sahara and Abyssinia, is an aberrant species of dog, distinguished from the typical Canis by having four toes on each foot, and other structural peculiarities. It is about as tall as a grayhound, its legs being relatively long and slender, and adapted to the swift and enduring speed upon which it must depend for a livelihood. The head is broad and flat, with a short muzzle armed with massive teeth, rather large upstanding furry ears, and a suggestion of the hyena in the physiognomy; hence it is sometimes called "hyena-dog," though the likeness is wholly superficial. The fur is short, thick, and smooth, and grows more shaggy about the cheeks and throat; and the tail is long and wolf-like. In general color this dog is yellowish gray, but it is marked most irregularly with a variety of colors, such as a combination of red, white, yellow, and black spots, so that the hyena-dog may be regarded as the most parti-colored of all mammalia.

HUNTINGDON (contracted Hunts), a small inland county of England, surrounded by the counties of Northampton, Cambridge and Bedford; area, 229,515 acres. Pop. 57,772.

HUNTINGTON, the county seat of Huntington co., Ind., on the Little river, the Wabash and Erie canal, and the Wabash and the Erie railroads; 24 miles s.w. of Fort Wayne, 118 s.w. of Toledo. It is the commercial center of the Upper Wabash valley, and the place of manufacture of the famous Huntington white lime. The shops and division headquarters of the Erie railway are here. Pop. 11,291.

HUNTINGTON, village; Suffolk co., N. Y., on Huntington Bay, which opens into Long Island Sound, and on the Long Island railroad; 38 miles e. of New York. The town of the same name includes Lloyd's Neck and several villages. Pop. 11,260.

HUNTINGTON, the county seat of Cabell co., West Va., on the Ohio river, and the Ches. and O., the Newport News and Miss. Val., and the Ohio river rails ways; 52 miles w. of Charleston, the state capital. Pop. 14,323.

HURA, a genus of tropical American plants, the sand-box tree, is remarkable for the loud report with which its seed-

Sand-box tree.

vessel bursts. It is a large branching tree with glossy poplar-like leaves, inconspicuous dicœcious flowers, and large, furrowed, roundish fruits of the size of an orange.

HURDLES, frames formed of perpendicular stakes with horizontal bars, and braced with diagonal pieces for the purpose of forming temporary fences. In fortification the name is given to a collection of twigs or sticks closely interwoven and sustained by long stakes, and serving to render works firm, or to cover traverses and lodgments for the defense of workmen against fireworks or stones.

HURDY-GURDY, a stringed instrument, played by turning a handle. Its tones are produced by the friction of a wheel acting the part of a bow against

Hurdy-gurdy.

four strings, two of which are pressed by the fingers or by keys. The other two strings are tuned a fifth apart to produce a drone bass, and are not stopped by the fingers or keys.

HURON, Lake, one of the five great lakes on the frontiers of the United States and Canada. It is the third in size, being 218 miles long north and south, and (including Georgian Bay) 180 miles broad at its widest part, with an area of about 21,000 miles. It lies 578 feet above sea-level. The lake contains several thousand islands, varying in size from a few square feet to huge islands like the Great Manitoulin, which is about

107 miles long and from 4 to 25 miles wide, and is the only one inhabited. The waters are very clear and pure, abound in fish, and have a depth averaging from 800 to 1000 feet.

HURONIAN-ROCKS, in geology, a term applied to certain rocks on the banks of Lake Huron, consisting of quartzite, with masses of chloritic schist. They occupy the same relative position as the upper parts of the Archæan rocks of Britain.

HUSBAND AND WIFE, recent legislation in most countries has been in the direction of putting husband and wife on an equality, whereas formerly the wife to a great extent lost her separate status on marriage. Thus, for instance, by the English common law her personal property passed at once to her husband on marriage, though this might be obviated by special settlements, etc. But the law no longer stands so, especially since the act of 1882. By this statute a married woman can acquire, hold, and dispose by will or otherwise, of property as if she were an unmarried woman, and may enter into any contract, and sue or be sued without the participation of her husband. A woman carrying on a business separately from her husband is subject to the bankruptcy laws as if she were unmarried. Every married woman has, even against her husband, the same civil remedies, and also the same remedies by way of criminal proceedings for the protection and security of her own property as if she were unmarried; but she cannot take criminal proceedings against her husband while they are living together. Generally a husband is not bound by the contracts of his wife unless they are made by his express or implied authority. See also Marriage, Divorce, Adultery, etc.

HUSS, or **HUS,** John, Bohemian religious reformer, born about 1373. He studied at the University of Prague, took the degree of Master of Arts in 1396, and in 1398 began to lecture on theology and philosophy. In 1401 he was made dean of the faculty of philosophy, became the leader of the Bohemian in opposition to the German professors and academicians, and after the withdrawal of the latter to Leipzig, was made rector of the university (1409). Since 1391 he had been acquainted with the writings of Wickliffe, and his denunciation of the papal indulgences, of masses for the dead, of auricular confession, etc., alarmed Archbishop Sbynko of Prague, who had 200 volumes of Wickliffe's writings burned (1410) in the archiepiscopal palace, and the preaching in Bohemian prohibited. He was sentenced to death on July 6, 1415, and burned alive the same day, and his ashes thrown into the Rhine.

HUSSARS', originally the name of the Hungarian cavalry, raised by Matthias I. in 1458. Every twenty houses were obliged to furnish a man, and thus from the Hungarian word husz (twenty) was formed the name Huszar, Hussar, afterwards applied generally to light cavalry, similarly dressed and armed, of other European armies.

HUSSITES, the followers of John Huss. After the death of Huss, his adherents took up arms for the defense of their principles, and under the leadership of Johann Ziska, captured Prague, fortified Mount Tabor, and repeatedly defeated the troops sent against them by the Emperor Sigismund, who had succeeded to the crown of Bohemia. Ziska died in 1424, and was succeeded by Procopius, who also distinguished himself by many victories.

HUSTINGS, (1) a name given to a court formerly held in many cities of England, as York, Winchester, Lincoln, but especially applied to the county court of the city of London held before the lord-mayor, recorder, and sheriffs. (2) The platform from which candidates for political preferment address their constituents.

HUTCHINSON, the county seat of Reno co., Kan., on the Arkansas river, here spanned by four bridges, and the Atch., Top. and S. Fé, the Chi., R. Is. and Pac., the Hutch. S., and the Mo. Pac. railways; 168 miles w. by s. of Topeka. It contains the largest and purest deposit of rock salt in the United States. It is the seat of the state reformatory. Pop. 11,189.

HUTTON, James, Scottish geologist, born at Edinburgh in 1726. Among his numerous works are an Investigation of the Principles of Knowledge, Theory of Rain, Theory of the Earth, with Proofs and Illustrations (1795). He died in 1797.

HUXLEY, Thomas Henry, English naturalist, born May 4, 1825. He graduated M. B. at the University of London in 1845, and entered the royal navy as assistant-surgeon in 1846. He

Thomas Henry Huxley.

sailed with H.M.S. Rattlesnake on a surveying expedition to Australasia, during which he sent a number of valuable papers to the Royal Society. After being professor of natural history in the School of Mines, Fullerian professor of physiology to the Royal Institution, Hunterian professor in the Royal College of Surgeons, president of the British Association meeting held at Liverpool in 1870, lord-rector of Aberdeen University in 1872, secretary of the Royal Society, substitute professor of natural history for Professor Wyville Thompson at Edinburgh in 1875 and 1876, a member of various royal commissions on fisheries vivisection, universities, etc., and inspector of salmon fisheries, he resigned this and almost all his other offices in 1885 on account of ill health. Among his works are The Oceanic Hydrozoa (1857), On the Theory of the Vertebrate Skull, Man's Place in Nature (1863), On Our Knowledge of the Causes of the Phenomena of Organic Nature, a series of lectures to working-men delivered in 1862, Elements of Comparative Anatomy (1864), Elementary Physiology (1866), Introduction to the Classification of Animals (1869), Lay Sermons, Addresses, and Reviews (1870), Critiques and Addresses (1873), American Addresses (1877), Physiography (1877), Anatomy of Invertebrate Animals (1877), The Crayfish (1879), Science and Culture (1882), etc. He died at Eastbourne, June 29, 1894.

HUYGENS (hoi'gens), Christian, Dutch mathematician and physicist, born in 1629. He died at the Hague in 1695. Among his most important contributions to science are his investigations on the oscillations of the pendulum and his System of Saturn, in which he first proved that the ring completely surrounds the planet, and determined the inclination of its plane to that of the ecliptic. In 1690 he published important treatises on light and on weight. His Traité de la Lumiére was founded on the undulation theory, but in consequence of the prevalence of the Newtonian theory it was long neglected till later researches established its credit.

HY'ACINTH, a genus of liliaceous bulbous plants, including about thirty species, among which the garden hyacinth is celebrated for the immense varieties which culture has produced from it. It is a native of the Levant, and was first cultivated as a garden flower by the Dutch about the beginning of the 16th century.

HY'ACINTH, or **JACINTH,** a variety of the mineral zircon, whose crystals, when distinct, have the form of a four-sided prism, terminated by four rhombic planes, which stand on the lateral edges. Its prevailing color is a red, more or less tinged with yellow or brown. The name hyacinth is also given to varieties of the garnet or cinnamon stone, the sapphire, and topaz.

HY'ADES, a cluster of five stars in the constellation Taurus, supposed by the ancients to indicate the approach of rainy weather when they rose with the sun.

HYBRID, the produce of a female animal or plant which has been impregnated by a male of a different but nearly allied species or genus. Much uncertainty prevails respecting the productive crossing of species, but it seems to be established that while the crossing of different genera may result in offspring, that of different orders will not. Hybrids are obtained among fishes from different species of carp; among birds, from the goldfinch and canary, the swan and the goose, etc.; among mammals, from the horse and the zebra, the horse and the ass, the produce of the last two being the mule proper; from the lion and tiger, the dog and wolf, the dog and fox, the goat and ibex. Instances of hybrids between animals of different genera have been furnished by the union of the goat and the antelope, and of the stag and the cow. It used formerly to be considered that the propagative power of hybrids was either

absolutely null, or that they propagated only with an individual of the pure breed; but the experiments of Mr. Darwin and other recent researches have shown that although infertility to some degree generally attends sexual intercourse between different species, yet in such intercourse every degree of difference from absolute sterility up to complete fertility is found. The results hitherto obtained may be summarized as follows: The crossing of species of different families is in almost every case infertile; allied species are capable of producing offspring, and this capability is in indefinite ratio to the degree of their likeness; hybrids are frequently fertile with their parents, but more rarely among themselves; there is no fixed relation between the degree of fertility manifested by the parent species when crossed and that which is manifested by their hybrid progeny. In many cases two pure species can be crossed with unusual facility, while the resulting hybrids are remarkably sterile; and, on the other hand, there are species which can only be crossed with extreme difficulty, though the hybrids when produced are very fertile.

HYCSOS, or HYKSHOS, or Shepherd Kings, wandering tribes of Semitic descent, who conquered the whole of Egypt about 2100 B.C., and were driven out some five hundred years afterward. The only detailed account of them in any ancient writer is a passage of a lost work of Manetho, cited by Josephus. Their epoch covers the 13th to the 17th dynasties.

HYDERABAD, or **HAIDARABAD,** a state of Hindustan, which comprehends the greater part of that central plateau of Southern India known as the Deccan, and is in possession of a Mohammedan prince, the Nizam; area, 80,000 sq. miles, exclusive of the Berar or Hyderabad Assigned Districts under British administration. The chief products are rice, wheat, maize, sugar-cane, tobacco, cotton, indigo, fruits, and timber Pop. 11,357,040. The ruler of Hyderabad belongs to a dynasty founded by Asaf Jah, a distinguished soldier, whom the Emperor Aurungzeb made rank the first Mohammedan ruler in India, with a regular army of about 15,000, besides numerous irregulars.—Hyderabad, the capital is situated on the river Musi, at an elevation of 1672 feet above the sea. There are manufactures of silks, trinkets, and turbans. Pop. of city and suburbs, 448,466.

HYDERABAD, or **HAIDARABAD,** a town of Hindustan, capital of Hyderabad, District Sind. It is situated on a rocky eminence about 3 miles from the eastern bank of the Indus. The principal manufactures are arms, silks, cottons, and lacquered ware. Pop. 69,378.—The district has an area of 9030 sq. miles; the pop. is 918,646.

HYDER ALI, a distinguished Indian prince, born in 1728, son of a general in the service of the Rajah of Mysore. By his military talents he became the actual ruler of Mysore, and in 1762 deposed Kandih Rao, and had himself chosen Rajah. In 1780 he formed an alliance with the Mahrattas against the English, took Arcot, but was defeated by Sir Eyre Coote, June 1, 1781. The Mahrattas now joining in a league against him, he carried on a disadvantageous

Hyder Ali.

war, during the continuance of which he died, in 1782. He was succeeded by his son, Tippoo Saib.

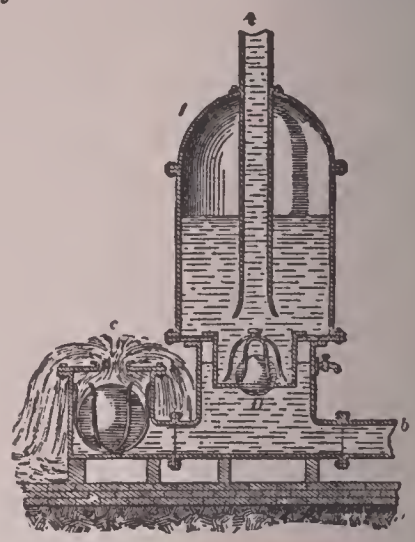
HYDRA, in Greek mythology, a celebrated monster, which infested the neighborhood of Lake Lerna in the Peloponnesus. Some accounts give it a hundred heads, others fifty, others nine. As soon as one of these heads was cut off two immediately grew up if the wound was not stopped by fire. It was one of the labors of Heracles to destroy this monster, and this he effected with the assistance of Iolaus, who applied a burning iron to the wounds as soon as one head was cut off.

HYDRANGEA (hī-dran'jē-a), a genus of shrubs containing about thirty-three species, natives of Asia and America. The garden hydrangea is a native of China. It is a favorite for the beauty and size of its flowers.

HYDRAULIC CRANE, a crane wrought by the pressure of water applied on the principle of the hydraulic or hydrostatic press. The mechanism consists of one or more such presses, with sheaves or pulleys and chains for the purpose of obtaining an extended motion in the chain from a comparatively short stroke of the piston. The power is applied not only for lifting the load, but also for swinging the jib, which latter object is effected by means of a rack or chain operating on the base of the movable part of the crane, and connected either with a cylinder and piston having alternate motion, like that of a steam-engine, or with two presses applied to produce the same effect by alternate action.

HYDRAULIC PRESS, known also as Hydrostatic Press or Bramah's Press. See Hydrostatic Press.

HYDRAUL'IC RAM, a machine for raising water, and depending for its action on the impulse of flowing water. The water falling from a reservoir passes into a pipe or chamber (b), at the end of which there is a ball valve (c). The rush of supply water at first closes this, and the water finding no exit there acquires pressure enough to open another valve (d) and pass into an air-vessel placed over it (f). The cessation of pressure at valve c allows it to fall again; an outrush of water takes place there, relieving valve d, which again closes. The pressure of the flowing water upon valve c once more closes this valve, and valve d again opens, and an additional quantity of water is forced into the air-vessel



Hydraulic ram.

and so on by a series of pulsations which send the water along the service pipe, and, in properly arranged machines, raises it to a very considerable height, although the impulse is derived only from the fall of a few feet.

HYDRAUL'ICS, that part of mechanical science which has to do with conducting, raising, and confining water, or of applying it as a motive power. It thus has to do with the flow of water in pipes or channels, and with the various machines in which water is utilized, such as water-wheels, pumps, turbines, the archimedean screw, the Barker's mill, the hydraulic ram, the hydraulic crane, the hydraulic or hydrostatic press, etc.

HYDROCARBONS, in chem., a series of compounds which consist of carbon and hydrogen only. They are produced chiefly by the decomposition of organic substances, either slowly by natural causes, or by artificial means, as in the case of the destructive distillation of coal for the purpose of making gas. Certain of the hydrocarbons are also found in the gums which exude from trees. Among the best known are paraffin benzine, turpentine.

HYDROCELE, a collection of serous fluid in some of the coverings of the testicle or spermatic cord, or in the areolar texture of the scrotum. It is generally the result of a strain or an inflammation of the testes. A large tumor is formed, filled with fluid, which has often to be drawn off three or four times a year. A radical cure may be effected by setting up an inflammation which brings the opposite surfaces of the sac into adhesion, and thus obliterates the cavity.

HYDROCEPH'ALUS, an accumulation of fluid within the cavity of the cranium; dropsy of the brain.

HYDROCHLORIC ACID, or **MURIATIC ACID,** a gaseous compound of equal volumes of hydrogen and chlorine. It is evolved during volcanic eruptions, and is found in the water which collects in the crevices of mountains, as well as in rivers which take their rise in volcanic

formations, especially in South America. It may be produced by decomposing common salt with sulphuric acid, or by bringing equal volumes of chlorine and hydrogen together and exposing the mixture to diffused daylight without condensation. It explodes in direct sunlight. Hydrochloric acid is colorless, has a pungent odor, and an acid taste. It is quite irrespirable, extinguishes flame, and dissolves very readily in water. The chief use of hydrochloric acid in the arts is to supply chlorine to the bleaching-powder manufacturer. It is also used in the preparation of glue, phosphorus, carbonic acid, artificial waters, etc. In medicine it is used diluted as a tonic and astringent. In a concentrated form it is a powerful caustic.

HYDROCYANIC ACID. Same as Prussic Acid.

HYDRODYNAM'ICS, a branch of the general science of dynamics, treating specially of the laws of force as applied to fluids. It is divided into hydrostatics, which is concerned with forces applied to fluids at rest, and hydrokinetics, which treats of the application of forces so as to produce motion in fluids. The term hydrodynamics is, however, very often used in the latter sense, being thus opposed to hydrostatics. The name Hydraulics is given to the subject when considered with respect to its practical bearing on engineering science.

HYDRO-ELECTRIC MACHINE, a machine in which electricity is generated by the friction of steam against the sides of orifices through which it is allowed to escape under high pressure.

HYDROFLUOR'IC ACID, or **FLUOHYDRIC ACID,** an acid which may be obtained either in the liquid form or in the anhydrous form, as a colorless gas. Both the dry and the liquid form act upon the skin with great virulence. Hydrofluoric acid is used chiefly for etching upon glass. The glass is covered with a thin coating of etching wax, and the design is traced through the wax down to the glass with a fine-pointed instrument. The plate is then treated either with an aqueous solution of the acid or is exposed to the gas itself. After a sufficient length of time the wax is dissolved away and the design becomes visible. In chemistry hydrofluoric acid is used to decompose and dissolve silicates in mineral analysis.

HY'DROGEN, an important elementary substance, one of the elements of water and a component of all vegetable and animal products. It may be obtained by passing the vapor of water over red-hot iron filings, or by submitting water to the action of an electric current, whereby it is decomposed into its elements hydrogen and oxygen. Pure hydrogen is a colorless, tasteless, inodorous gas; it is very inflammable, burning with a pale, very slightly luminous, but intensely hot flame; it is a powerful refractor of light; the least dense and the most rapidly diffusible of all the gases and the lightest body in nature, being about 14½ times lighter than atmospheric air, with a specific gravity of .0693. In consequence of its extreme lightness it is the recognized standard of unity in referring to the atomic weight of bodies, and it has also been assumed as the unit in speaking of the specific gravity of gases, although common air is the more generally received standard. Hydrogen cannot support respiration, but is not directly poisonous, death ensuing from mere absense of oxygen. Two volumes of hydrogen with six of air form an explosive mixture. The most intense heat that can be produced is caused by the burning of hydrogen in oxygen gas, and this principle has been applied to increase the temperature of blast-furnaces in iron-works by making the gases pass separately through heated tubes to the furnace. Hydrogen is only slightly soluble in water, nor is there any other liquid which is capable of dissolving it in great quantity. Hydrogen gas can be liquefied by exposure to 650 atmospheres pressure, and 140° c., but remains liquid at 320 atmospheres pressure, the temperature remaining the same. It unites with all other elementary gaseous bodies, and forms with them compounds, not only of great curiosity, but of vast importance and utility: with nitrogen it forms ammonia; with chlorine, hydrochloric acid; with fluorine, hydrofluoric acid, etc.

HYDROG'RAPHY, that branch of geographical science which has for its object the description and natural phenomena of the water on the surface of the globe, whether in seas, lakes, or rivers. It may deal with the rivers, watersheds, lakes, etc., of a particular country; and it also embraces the determination of winds, currents, and other departments of marine-surveying. In Britain, France, the United States, etc., there are hydrographic departments kept up by government, which publish accurate charts of coasts, issue sailing directions, etc.

HYDROKINET'ICS, that branch of hydrodynamics which treats of the application of forces producing motion in fluids, having thus to do with the flow of liquids in pipes, its issue from orifices under certain pressures, etc.

HYDROM'ETER, an instrument primarily for determining the specific gravity of fluids, though some of them can also determine the specific gravity of solids. The hydrostatic principle on

Hydrometer.

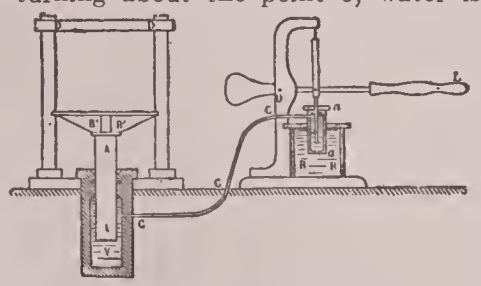
which the use of the hydrometer depends is the well-known one that when a solid body floats in a liquid, and thus displaces a quantity of the liquid, the weight of the solid body is equal to the weight of the liquid that it displaces. The density of the liquid is determined either by observing the depths to which the hydrometer sinks in the liquid (the hydrometer of variable immersion) or the weights required to make it sink to a given depth (the hydrometer of constant immersion). Of the second kind of hydrometer Nicholson's is a good example. It consists of a hollow cylinder of metal, surmounted with a very fine metallic stem, to the top of which there is attached a plate or pan for weights. From the bottom of the metallic cylinder hangs a kind of cup or basket. The whole instrument is weighted so as to float upright. On the fine metallic stem there is a marked point: and by putting weights on the upper pan the hydrometer is always made to sink precisely to this point. Thus the volume immersed is always the same. From what was said above, it is seen at once that different weights are required to sink it to the marked point in different liquids, the denser the liquid the greater being the weight required: and if the weight of the instrument itself is known, and also the standard weight, or weight required to sink it to the marked point in distilled water, the calculation of the specific gravity of any liquid from an observation with the instrument is very easy. But the specific gravity of solids can also be found by means of Nicholson's hydrometer, for which purpose the instrument is placed in distilled water and the solid body is put on the upper pan. Weights are then added till the hydrometer sinks to the marked point. But the standard weight of the instrument being known, it is plain that the difference between it and the weights that must be added on the upper pan to the weight of the body whose specific gravity is to be determined must be the weight in air of that body. The body is now transferred to the basket below the instrument, and the additional weights which must now be placed in the dish represent the weight of water displaced by the solid; and the weight of the solid itself divided by this weight is the specific gravity required. Hydrometers of variable immersion are usually made of glass. Each of them has a large hollow bulb, below which there is a smaller bulb weighted with mercury to make the instrument float upright. The stem is cylindrical and is graduated, the divisions being frequently marked on a piece of paper inclosed within the stem. The depth to which the hydrometer sinks in the liquid gives the density.

HYDROP'ATHY, a method of treating diseases by the use of pure water both internally and externally. The system was originated by Vincent Priessnitz, a Silesian peasant, who in 1829 established at his native village of Gräfenberg an institution for the hydropathic treatment of diseases, and invented a variety of forms in which the water cure might be applied, such as the wet-sheet pack, the dry blanket or sweating pack, the sitz, douche, plunge, wave, etc., baths.

HYDROPHO'BIA, a specific disease arising from the bite of a rabid animal. The animals most liable to be afflicted with madness are dogs; but cats, wolves, foxes, etc., are also subject to it. The early symptoms of rabies in the dog are such as restlessness and general uneasiness, irritability, sullenness, an inclination for indigestible and unnatural food, and often a propensity to lap its own

urine. As the disease proceeds the eyes become red, bright, and fierce, with some degree of strabismus or squinting; twitchings occur round the eye, and gradually spread over the whole face. After the second day the dog usually begins to lose perfect control over the voluntary muscles. He catches at his food, and either bolts it almost unchewed, or, in the attempt to chew it, suffers it to drop from his mouth. This want of power over the muscles of the jaw, tongue, and throat increases until the lower jaw becomes dependent, the tongue protrudes from the mouth, and is of a dark, and almost black color. A peculiar kind of delirium also comes on, and the animal snaps at imaginary objects. His thirst is excessive, although there is occasionally a want of power to lap. His desire to do mischief depends much on his previous disposition and habits. He utters also a peculiar howl, and his bark is altogether dissimilar from his usual tone. In the latter stages of the disease a viscid saliva flows from his mouth, and his breathing is attended with a harsh, grating sound. The loss of power over the voluntary muscles extends after the third day, throughout his whole frame, he staggers in his gait, and frequently falls. On the fourth or fifth day of the disease the dog dies, sometimes in convulsions, but more frequently without a struggle. In regard to man the rabid virus seems to be more violent when it proceeds from wolves than from dogs. It appears to be contained solely in the saliva of the animal, and does not produce any effect on the healthy skin. But if the skin is deprived of the epidermis, or if the virus is applied to a wound, the innoculation will take effect. The development of the rabid symptoms is rarely immediate; it seldom takes place before the fortieth or after the sixtieth day, but in some cases has occurred after six months or even longer. It begins with a slight pain in the scar of the bite, sometimes attended with a chill; the pain extends and reaches the base of the breast, if the bite was on the lower limbs, or the throat, if on the upper extremitics. The patient becomes dejected, morose, and taciturn, He prefers solitude, and avoids bright light; frightful dreams disturb his sleep; the eyes become brilliant; pains in the neck and throat ensue. These symptoms precede the rabid symptoms two or three days, They are followed by a general shuddering at the approach of any liquid or smooth body, attended with a sensation of oppression, deep sighs and convulsive starts, in which the muscular strength is much increased. A foamy, viscid slaver is discharged from the mouth; the deglutition of solid matters is difficult; the respiration hard; the skin warm, burning, and afterward covered with sweat; the pulse strong; the fit is often followed by a syncope; the fits return at first every few hours, then at shorter intervals, and death takes place generally on the second or third day. No means have yet been found of arresting the progress of the poisonous virus after it has once developed in the system. The treatment, therefore, consists in preventing its development, which may be effected by applying a ligature, where possible, to impede the circulation from the wound, by sucking it, and thoroughly cauterizing it either with nitrate of silver or with iron heated to a white heat, the pain of cautery being less as the temperature is greater. If these means are not available any burning substance and most acids may be used. Within a quite recent period M. Pasteur put forward a method of preventing the development of the disease by a system of successive inoculations with rabid virus of greater and greater intensity; the inoculation being made the first day with marrow which has been extracted from the rabid animal, 12, 10, and 8 days; then the second day with marrow extracted 6, 4, and 2 days; the third day with one day's marrow, etc. M. Pasteur's method has been favorably reported on by an English commission but there is perhaps some room for doubts regarding the number of cures really performed. As a sharp critic of the Pasteur system has remarked, every one who is bitten and inoculated is counted in the list of cures, though there is nothing to prove that he ever contracted the rabies.

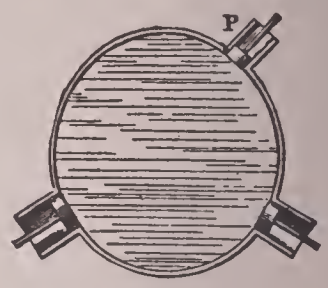
HYDROSTAT'IC PRESS, or BRAMAH'S PRESS, a hydrostatic apparatus which in its practical application was invented by Bramah in 1796. It will be understood from the accompanying figure. By means of a suction and force pump a a, worked by the lever or handle l turning about the point o, water is



Section of hydrostatic press.

drawn from the reservoir b′ b′ and forced along the tube c c into the cistern v through the top of which a heavy metal plunger a a works. On the upper end of the plunger is a large plate b b upon which the goods to be pressed are placed. When water is pumped from the reservoir b b into the cistern v, the pressure exerted by the plunger of the pump is transmitted according to the well-known hydrostatic principle to the bottom of the plunger a, which accordingly rises and carries the objects placed on plate b′ b′ up against the top of a fixed frame d d. It was the invention by Bramah of a water-tight leather collar surrounding the piston that made the use of the press practicable; before his invention not much power could be developed from the escape of the water round the piston. The collar consists of a leather ring bent so as to have a semi-circular section, so that the water passing between the piston and cylinder fills the concavity of the collar, and by pressure produces a packing which fits the tighter as the pressure on the piston increases. The hydrostatic press may be constructed to give pressures of two or three hundred tons, and is extensively employed where very great force is required, as in testing anchors or raising very heavy weights.

HYDROSTATICS', is that part of the general science of hydrodynamics that treats of the application of forces to fluids at rest. Among the chief princi-



Pascal's principle.

ples of hydrostatics may be mentioned the following: (1) The intensity of pressure at any point of a fluid is the same in all directions; it is the same whether the surface that receives the pressure faces upward, downward, horizontally or obliquely. (2) When a fluid is confined, if the intensity of pressure in one part be increased, as by forcing in a piston or by any other means, an equal increase will be produced in the intensity of pressure at all other parts: in other words, pressure applied to any one part is transmitted without any change in its intensity to all other parts. The diagram will aid in the understanding of this. If pressure is applied to p it will be transmitted in all directions through the liquid. If other openings are made, and if they are fitted with pistons, the pressure that must be applied to any piston equal in area to the area of p is equal to the pressure on p; and if the area of one of the other pistons is greater or less than the area of p, the pressure required to keep it in its place is proportionately greater than or less than the pressure that is applied to p. This principle, which is known as Pascal's principle from being distinctly formulated by him, is the most important in hydrostatics, and finds a practical application in the Hydrostatic, or Bramah's Press (see above). (3) Not only is pressure transmitted out to the surface or envelope of the liquid, but within the fluid itself the particles are all pressed together. When a solid is immersed in the liquid it is pressed at every point of its surface in the direction perpendicular to the surface at that point.

HYDROSULPHU'RIC ACID, or sulphuretted hydrogen or hydrothionic acid is a colorless imflammable gas produced by the putrefaction of sulphurous organic matters. Many mineral waters contain it naturally. It may be artificially produced by burning sulphur vapor in hydrogen, or by passing hydrogen through sulphur. It has a sweet taste but a very nauseous odor as of rotten eggs. It has poisonous effects when breathed, and experiments have shown that birds perished in air which contained $\frac{1}{1500}$th part of the gas.

HYE'NA, a genus of digitigrade carnivorous quadrupeds, constituting a family which unites the skull characters of the Felidæ (cats) with the skeleton

and gregarious habits of the Canidæ (dogs). The characters of this genus are five molars above, and five or four below, on each side, the three anterior molars being conical, smooth, and remarkably large, adapted for breaking the bones of their prey; the tongue is rough; the legs are each terminated by

Striped hyena.

four claws; the forelegs are longer than than the hind legs; the eyes large and prominent; the ears long and acute: the jaws are remarkable for the strength of their muscles, and can crush the hardest and most massive bones with ease. The genus is confined to Africa and Asia. There are three species known—the striped, the spotted, and the brown hyena. They are nocturnal animals, extremely voracious, feeding chiefly on carrion, and thus being of great utility in the countires where they live; to obtain dead bodies they will even dig up graves.

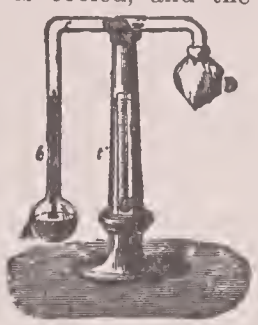
HYGIEIA (hī-ji-ē′ ya), the Greek goddess of health, daughter of Asclepius, or Æsculapius. Her temple was placed near that of Æsculapius, and her statues

Hygieia, from antique statue.

were even erected in it. She is represented as a blooming maid with a bowl in her hand, from which she is feeding a snake, the symbol of health.

HYGIENE (hī′ji-ēn), the department of medicine which treats of the preservation of health, and the duration of life prolonged by a due attention to physiological or natural laws. It is usually divided into public and private hygiene, the former having to do with measures for excluding causes of disease, methods of securing cleanliness in the streets and dwellings, methods of maintaining the purity of the supply of food and drink; the latter may be considered to embrace such subjects as alimentation, clothing, exercise and muscular development, etc.

HYGROM′ETER, an instrument for measuring the degrec of moisture of the atmosphere. The chief classes of hygrometers depend either upon absorption or upon condensation. Of the former kind is the hygrometer of Saussure, in which a hair, that expands and contracts in length according as the air is more or less moist, is made to move an index. Of the latter sort is Daniell's hygrometer. This instrument consists of a bent glass tube, terminating in two bulbs, the bulb a being two-thirds filled with sulphuric ether, and the bulb b being at the commencement of an experiment, empty. The latter is covered with muslin. In process of construction the tube is exhausted of air, and is thus filled with vapor of ether through its entire length. A thermometer (t) whose bulb is immersed in the ether of the lower arm, is inserted in the tube to register variation of temperature, and a second thermometer (t′) is attached to the stand of the instrument, to show the temperature of the outer air. If sulphuric ether be dropped on the bulb b, as it evaporates the bulb is cooled, and the vapor of



Daniell's hygrometer.

ether is condensed within it from the bulb a; while owing to the evaporation from a into b the temperature of the former gradually falls. The operation is carried on till the temperature of a is so far reduced that dew from the surrounding air just begins to condense upon it. By means of the thermometer contained in a the temperature is read off at the instant at which vapor begins to condense, and the dew-point is thus obtained. The hygrometric condition, that is, the ratio between the quantity of moisture that the air actually contains and the quantity which it is capable of containing at the existing temperature, is then easily deduced. Regnault's hygrometer is a modification of the principle of Daniell's instrument, the ether being evaporated by forcing air through it.

HYKSHOS. See Hycsos.

HY′MEN, Hymenæus, the god of marriage in Grecian mythology. No marriage took place without his being invoked to sanction it. He is described as having around his brows the flowers of majoram, in his left hand the flame-colored nuptial veil, in his right the nuptial torch, and on his feet golden sandals. He is a taller and more serious Eros, and is accompanied by song and dance.

HYMENOP′TERA, an extensive order of insects, comprising bees, wasps, ants, ichneumon-flies, gall-flies, saw-flies and allied insects. They are characterized by four membranous naked wings which have comparatively few veins. The second pair of wings is always smaller than the first. The mouth parts are provided with biting jaws and a suctorial organ. The head is freely movable, and besides the lateral compound eyes, there are usually three ocelli on the top of the head. The Hymenoptera undergo complete metamorphosis. Females have the extremity of the abdomen furnished either with an ovipositor, forming a boring organ, or a

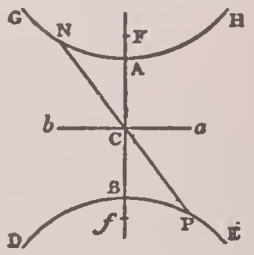
Hymenoptera. *o*, Ovipositor of female.

sting. Hence the two sub-orders into which Hymenoptera are divided are that comprising the saw-flies, gall-flies, ichneumon-flies, etc., and that which include the bees, wasps, ants, hornets, etc.

HYMN, originally a song of praise sung in honor of gods and heroes on festivals, with the accompaniments of music and dancing. Among the Hindus the hymns of the Rig-Veda, among the Hebrews the psalms, and among the Greeks the so-called Orphic and Homeric hymns are good examples. The early Christian hymns are full of devotional feeling. Their use dates from the first days of the church. The use of hymns was sanctioned by the fourth council, at Toledo, in 633. Several of them have names derived from the words with which they begin, as the Te Deum, Adeste Fidelcs, etc

HYPA′TIA, a Greek female philosopher of the eclectic school, the daughter of Theon, a celebrated astronomer and mathematician of Alexandria toward the close of the 4th century after Christ, at which period she was born. The Rev. C. Kingsley has chosen the story of Hypatia as the subject of a romance.

HYPER′BOLA, in geometry, a curve formed by cutting a cone in a direction parallel to its axis, or so that the cutting



Hyperbola—D B E, G A H, are opposite hyperbolas; F, *f*, foci; C, center; A B, transverse axis; *a b*, conjugate axis; N C P, diameter.

plane makes a greater angle with the base than the sides of the cone makes and when produced cuts also the opposite cone, or the cone which is the continuation of the former, on the opposite side of the vortex, thus producing another hyperbola, which is called the opposite hyperbola to the former.

HYPER′BOLE (-bo-lē), a rhetorical figure, in which an idea is expressed with a fanciful exaggeration of phrase which is not to be taken too literally, but only as representing a certain warmth of admiration or emphasis.

"His fame reaches to the stars" is an example of hyperbole.

HYPERI'DES, an Athenian orator, the pupil of Plato and Isocrates, born about 400 B.C. We was murdered at Ægina by the emissaries of Antipater in 322 B.C. Of his orations one has reached us nearly entire; the others only in fragments.

HYPERION (hī-pēr-ī'on or hī-pē'ri-on), in the most ancient mythology of Greece, the god of the sun, afterward identified with Apollo; also one of the Titans.

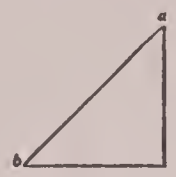
HYPOCHOND'RIA, a disorder arising from a disturbance of the functions of the nervous system. It is a form of melancholia. The sufferer lives under the generally groundless apprehensions of different diseases. Uninterruptedly occupied with the state of his body he takes notice of every feeling, and wishes to have every trifling pain explained, considering every one as a symptom of a serious disease. For everything he wants physic. Hypochondria is, physically considered, not a dangerous disease, although it makes the life of the sufferer a torment to himself and his friends. It is occasioned mainly by too great mental exertion, by too sedentary a life, by sexual indulgence or excess in exciting liquors; and also by want of exercise of the physical and mental powers producing ennui. It can be cured, but slowly, by the avoidance of the habits likely to occasion it, by the adoption of a steady and regular life, with moderate exercise for the mind and body, and the help of cheerful society.

HYPODER'MIC INJECTIONS, injections of some substance beneath the skin; a method adopted in medicine when the condition of the stomach or other organs renders the use of drugs by the mouth objectionable, or when rapidity of action is desired. The medicine is introduced by a small glass syringe fitted with a long, hollow, needle shaped point of steel.

HYPOPHOS'PHITES, salts of hypophosphorous acid, especially certain medicinal salts, chiefly the hypophosphites of potassium, sodium, and calcium. They have been used with considerable advantage in disorders of the blood and the digestive organs, and have also been found of benefit in consumption, although failing to effect a cure.

HYPOSUL'PHITES, salts of hyposulphurous acid. Among the most important are the hyposulphites of sodium and calcium, the former of which is used in medicine as an external remedy in paracitic skin disorders and an internal one in checking fermentation in zymotic diseases. It is variously used in bleaching, photography, and other arts as an antichlore, a dissolvent of bromide and iodide of silver, etc.

HYPOT'ENUSE, in geometry, the longest side in a right-angled triangle, namely that one which subtends or is opposite to the right angle. One of the most important propositions of Euclid's



a b, Hypotenuse.

Elements is the forty-seventh of the first book, discovered by Pythagoras, which proves that the square described on the hypotenuse is equal to the sum of the squares described on the other two sides.

HYPOTHECATION, the act of assigning something in security without giving up the possession of it.

HYPOTH'ESIS, etymologically a supposition, is popularly used to denote something not proved. but assumed for the sake of argument. In scientific and philosophical usage it denotes either a probable theory of phenomena not yet fully explained, or a strictly scientific theory which accounts for all the known facts of the case, and which only needs the verification of subsequent observations and deductions to become a certainty. Thus the conjecture of Newton that the force of gravity, as exemplified on the earth, might extend to the moon, was in its first stage a probable hypothesis; but when it was found to account for all the facts, it became a scientific hypothesis or theory.

HYSSOP, a perennial shrubby plant rising to the height of 2 feet, a native of Siberia and the mountainous parts of Austria. It flowers from June to September. The leaves have an agreeable aromatic odor, and a slightly bitter and somewhat warm taste. Its was once esteemed as a medicine, but has now fallen into disuse.

Hyssop.

HYSTE'RIA, a nervous affection to which women are subject, generally occurring in paroxysms, characterized by alternate fits of laughing and crying, convulsive struggling alternately remitting and exacerbating, sense of suffocation, palpitation of the heart, the sensation of a ball ascending from the pit of the stomach, occasioning a feeling of strangulation (globus hystericus), etc. Women of a delicate habit, and whose nervous system is extremely sensitive are the most subject to hysterical affections; and the habit which predisposes to these attacks is acquired by inactivity and a sedentary life, grief, anxiety, and various physical disorders. They are readily excited, in those who are subject to them, by strong emotions, especially if sudden. Hysterical complaints are best prevented by a judicious care of the moral and physical education of girls. Men are sometimes, but rarely, subject to disorders not essentially different.

I

I, the ninth letter and the third vowel of the English alphabet, in which it represents not only several vowel sounds but also the consonantal sound of y. The two principal sounds represented by it in English are the short sound as in pit, pin, fin, and the long as in pine, fine, wine, the latter being really a diphthongal sound. It has also three other sounds, viz., that heard in first, dirk (ė, the neutral vowel); that heard in machine, intrigue (which, however, can scarcely be considered a modern English sound); and the consonant sound heard in many words when it precedes a vowel, as in million, opinion, trunnion. I and J were formerly regarded as one character.

IAM'BUS, in prosody, a foot of two syllables, a short and a long one (⏑ —), or an unaccented syllable followed by an accented one. The iambic meter is the fundamental rhythm of many English verses. The verse of five iambic feet is a favorite meter, being the heroic verse of English, German, and Italian poetry.

Ibex.

IB'ADAN, a town of Western Africa, in the colony of Lagos, 122 miles from Lagos by railway. Pop. 100,000.

I'BEX, a name of two or three species of goats. The horns of the male are flattened, have two longitudinal ridges at the sides, and are crossed by numerous transverse knots. The horns of the female are short, more erect, with three or four knots in front. The best-known varieties are of the Alps and Apennines, the steinbock of the Alps, and the Pyrenean steinbock. Another species inhabits the lofty rocky peaks of Mount Caucasus.

I'BIS, a genus of birds allied to the storks, the most remarkable species being the sacred ibis. This is found throughout Africa. It is about the size

of a common fowl, with head and neck bare, and white plumage, the primaries of the wings being tipped with black and the secondaries being bright black, glossed with green and violet. It was reared in the temples of ancient Egypt

Sacred ibis of Egypt.

with a degree of respect bordering on adoration, and after death was preserved in a mummified condition The cause of its being deemed sacred was no doubt because it appeared in Egypt with the rise of the Nile; but it is now rare in that country, living farther south.

IB'SEN, Henrik, Norwegian dramatist and lyric poet, born in 1828. His first play, Catilina, was produced in Christiania in 1850. He was successively director of the theater at Bergen and of the Norske theater at Christiania, which he managed in 1857–62. In 1864 he left his native country and up till 1892 he resided chiefly abroad. On his seventieth birthday Ibsen received gifts and greetings from all parts of the world. His dramas are partly in prose, partly in verse, and include historical plays and satirical comedies of modern life. His works include The Pretender, Peer Gynt, The Pillars of Society, A Doll's House, Hedda Gabler, When We Dead Awaken, etc. He died in 1906.

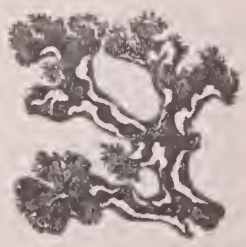
ICE, water frozen into a solid mass. Water freezes when its temperature is reduced below a certain point, which is by universal consent made a fixed point on thermometers. That point is called zero on the Centigrade and Réaumur scales, and 32° on the Fahrenheit scale. Water near the freezing-point presents the curious anomaly of expanding instead of contracting as the cooling process goes on. At 4°.1 Centigrade (39°. Fahr.) water has its maximum density-point. At temperatures below 4°.1 the volume of the water increases as the temperature falls, and decreases as the temperature rises; and at the moment of solidifying the volume of the mass suddenly increases to a very considerable extent, so that ice at the temperature of freezing is one-ninth greater in volume than the water from which it is formed is at 4°.1. It is on this account that water freezes at the top first, and that ice when frozen floats at the top of the water. The temperature at which pure water becomes ice is very nearly constant under ordinary circumstances; and it is this fact, along with the ease of procuring water at the freezing temperature, or rather ice at the point of liquefaction, that has caused this temperature to be adopted as one of the fixed points in thermometers. The freezing-point is, however, slightly influenced by pressure. Increase of pressure lowers it, and the removal of pressure raises it. Salt water requires a lower temperature to freeze it than fresh water, and in the process a large part of the salt is rejected. Hence water obtained from the melting of sea-ice is nearly fresh. If water is kept perfectly at rest it may be reduced in temperature far below the freezing-point without turning into ice; but particles of solid matter such as dust must also be kept from falling into it. The expansion of water on its conversion into ice often gives rise to the exhibition of very great force, and produces very remarkable effects in nature. Much of the disintegration observed in rocks and stones during or immediately after frost is due to it, water having entered into their pores and cavities and burst off particles by its expansion. Ice, though it is very brittle, possesses the property of plasticity to a very remarkable degree, and can be moulded into any form by the application of pressure.

ICEBERGS, large masses of ice which have become detached from the shores of the arctic regions, and float about in the ocean at the mercy of the winds and currents. They are in fact pieces of glaciers detached from the parent mass by the action of the sea and by their own accumulating weight. They present the strangest and most picturesque forms, are sometimes miles in length, and rise to a height of perhaps 250 or 300 feet above the sea, the portion abov water being calculated at about an eighth of the whole.

ICELAND, an island belonging to Denmark, situated between the North Atlantic and the Arctic Oceans, 250 miles from Greenland and about 600 miles west of Norway; greatest length, east to west, 300 miles; central breadth, about 200 miles; area with adjacent isles, 40,000 sq. miles. The interior has generally a very wild and desolate appearance, being covered by lofty mountain masses of volcanic origin, many of them crowned with perpetual snow and ice, which, stretching down their sides into the intervening valleys, form immense glaciers. Among the volcanoes the most celebrated is Mount Hecla, in the south, about 5000 feet high. Numerous hot springs or geysers are scattered throughout the island, but are found more especially in the southwest, to the northeast of Reikjavik. The most valuable mineral product is sulphur, of which the supply appears to be inexhaustible; the other minerals deserving of notice are chalcedonies, rock crystals, and the well-known double-refracting spar, for which the island has long been famous. In the southern parts the longest day is twenty hours, and the shortest four, but in the most northern extremity the sun at midsummer continues above the horizon a whole week, and of course during a corresponding period in winter never rises. There are various flowering plants, among which saxifrages, sedums, thrift or sea-pink, etc., are common. Heath and bilberry cover large stretches. Among mosses or lichens are the edible Iceland-moss. Cole, potatoes, turnips, radishes, and similar roots thrive tolerab,y well. But by far the most valuable crop is grass, on which considerable numbers of live stock (sheep, cattle, ponies) are fed. The reindeer, though not introduced before 1770, has multiplied greatly and forms large herds in the interior; but they are of little importance economically. Wild-fowl, including the eider-duck whose down forms an important article of commerce, are abundant; the streams are well supplied with salmon, and on the coasts valuable fisheries of cod and herrings are carried on. Manufactures are entirely domestic, and consist chiefly of coarse woolens, mittens, stockings, etc. The exports are wool, oil, fish, horses, feathers, worsted stockings and mittens, sulphur, and Iceland-moss.

The inhabitants are of Scandinavian origin, and speak a Scandinavian dialect, which still represents the old Norse or Norwegian in great purity. They are of the protestant religion. Iceland has a constitution and administration of its own dating from 1874. There is an althing or parliament, which meets twice a year at Reikjavik, the capital, and consists of 36 members, of whom 30 are chosen by popular suffrage, and 6 nominated by the king. A minister for Iceland, nominated by the king, is at the head of the administration, but the highest local authority is vested in the governor. Pop. 78,470.

ICELAND-MOSS, a species of lichen found in the arctic regions, and on the upper parts of lofty mountains, as for instance in Scotland. It is used in



Iceland-moss.

medicine as a mucilaginous bitter, and in Iceland is collected as a nutritious article of diet. When boiled with milk or water it forms a jelly. Its bitterness may be removed by steeping.

ICELAND-SPAR, the transparent variety of calc-spar, a mineral noted for its property of exhibiting in a remarkable degree the double refraction of light.

ICE-PLANT, a plant which has received the above appellation from the transparent vesicles which cover its whole surface, and have the appearance of granules of ice. It is a native of South Africa and the Canaries, and is also found in Greece.

ICH DIEN (ēh dēn; German, "I serve"), motto of the Prince of Wales, assumed from that of the King of Bohemia, slain at the battle of Cressy, in which he served as a volunteer in the French army.

ICHNEU'MON, a genus of digitigrade carnivorous animals belonging to the civet family. They have a long slender body, a sharp and pointed muzzle, and

short legs. The most celebrated species inhabits Egypt, where it is called Pharaoh's rat. It was adored by the ancient Egyptians on account of its antipathy to crocodiles, whose eggs it digs out of the sand and sucks. It is expert in seiz-

Egytian ichneumon.

ing serpents by the neck so as to avoid any injury to itself. It is domesticated in Egypt, and more useful than a cat in destroying rats and mice. Their disadvantage, as domestic animals, is their predilection for poultry. The mungoos, or Indian ichneumon, is another species, not so large as the Egyptian, which it resembles in habits, being kept in many families as a useful domestic animal.

ICHNEUMON-FLIES, a large family of hymenopterous insects, which all agree in one particular, that they deposit their

Ichneumon-fly.

eggs either in or on the bodies, eggs, or larvæ of other insects. These apparently insignificant creatures confer inestimable benefits on man, as they destroy hosts of insects injurious to crops.

ICHTHYOL'OGY, that branch of zoology which treats of fishes. Fishes form the lowest of the five classes into which the great sub-kingdom Vertabrata is divided. They may be shortly described as vertebrate animals living in water and respiring the air therein contained by means of gills or branchiæ, having cold red blood, and a heart consisting of one auricle and one ventricle and having those organs which take the form of limbs in the higher vertebrata represented by fins. Their bodies are generally covered with scales overlapping each other, and their usual form (though with much diversity) is lengthened, compressed laterally, and tapering toward both extremities. The scales of fishes assume various forms, which have been classed under the four types of cycloid, ctenoid, ganoid, and placoid. Cycloid scales are of a rounded form, and are those met with in the most familiar fishes. Ctenoid scales, like those of the perch, have spinous projections from their posterior margin. Ganoid scales are in the form of thick bony plates covered with a superficial layer of enamel. Placoid scales form detached masses of various shapes often provided with spines. The skeleton presents great variations, from the amphioxus, in which vertebræ are only foreshadowed, to the well-ossified skeleton of teleostean fishes. The vertebræ are biconcave or "amphicœlous," the opposed surfaces forming cups, and they vary in number from seventeen to more than 200. The spinal column is prolonged into the tail, which is two-lobed, the lobes either being equal (a homocercal tail) or unequal (heterocercal). The skull varies greatly; it may be ossified throughout as in the cod-fish, or the cartilaginous cranium may persist, as in the lamprey, sharks, and rays. The skull is small compared to the size of the animals themselves. The limbs, when present, are four in number. The anterior or first part are called the pectoral fins. The ventral fins, or second pair of limbs, are variable in position, and not always present; they may be beneath the pectorals, when they are jugular; behind the pectorals, when they are thoracic; or farther back, abdominal. The pelvis is represented by two triangular bones, which have no relation to the spinal column, and to which the fin-rays are directly attached. The median or vertical fins, that is, those situated on the back, are characteristic of fishes, and they may extend nearly from the head continuously to the anal aperture, as in eels; they may be broken up into several dorsals, caudal, and one or more anals, as in the cod; or the number of dorsals may be increased greatly, as in the mackerel. The fins may be wholly soft and flexible, or they may be in part rigid spines; or a series of soft fin-rays may be preceded by rigid and often formidable spines, which sometimes have a beautiful mechanism for elevation and depression. The teeth of fishes are generally very numerous, and may be placed on any part of the interior of the mouth, sometimes on the tongue. They are quite different in character from the mammalian teeth. The muscular pharynx and œsophagus lead into a stomach usually well defined, but sometimes only slightly differing in caliber from the intestine. The liver is proportionally large, and has usually a gall-bladder. The heart consists of a single auricle and ventricle, which is continued forward by a dilated vessel called the arterial bulb (bulbus arteriosus). From this vessel the blood is sent right and left along the gills, which are the organs of respiration, and from the gills the aerated blood goes to the body. The gills or branchiæ are either free on one margin, as in ordinary fishes, or attached at both extremities. In the lepidosiren another structure appears, namely, lungs, which stretch through great part of the body and open on the posterior wall of the pharynx. A peculiar feature of fishes is the air-sac or swim-bladder, called also the sound. Anatomically its origin is identical with that of a lung; but it does not perform the functions of a lung. Its function is probably to serve as an aid in rising and sinking; but in some fishes it is prolonged so as to approach or even come in contact with the internal organs of hearing, perhaps as an organ of resonance. Reproduction is by ova or eggs, which in a few cases are retained in the body of the female till hatched. But the ova are usually fertilized outside the body, and the hatching process is usually left to take place without aid. The eggs are, in most cases, in enormous numbers, as in the roe of the herring and salmon. Among the sharks the number is much less, and each ovum acquires, before exclusion, a horny sheath of various shape, but usually provided with cirri, by which it moors itself to some fixed object. In the pipe-fishes the male has a marsupium or pouch formed by folds of the abdominal integument, and in this pouch the eggs, transferred thither on exclusion, are hatched. The nervous system of fishes presents considerable variety. The amphioxus has no enlargement of the nervous trunk comparable to a brain; but in all the others the division into fore, mid, and hind brain is clearly marked. The olfactory organs are, in most cases, pits or sacs, on whose walls the olfactory filaments are spread out. The sense of taste seems less provided for, the tongue and palate being mostly firm, and often set with teeth. There is no external ear, and the internal apparatus is not wholly inclosed in bone, as in the higher vertebrates, but is partly free in the cavity of the skull. The eye is, in most cases, relatively large and flattened externally, the sight being keen. Special organs of touch are wanting for the most part, though the labial filaments, seen in the cod, whiting, mullet, and sturgeon, are of this nature. Among the most curious appliances with which fishes are provided, are the electrical apparatus that appear in some species, as in the torpedo or electric ray and the electric eel, both of which posses batteries capable of giving a shock of considerable power. Some fishes inhabit exclusively either fresh or salt water; others, as the salmon, migrate periodically from the one to the other.

ICHTHYOR'NIS, a fossil genus of carnivorous and probably aquatic birds, one of the earliest known American

Fig. 1, Ichthyornis dispar, restored. Fig. 2, Right jaw, inner view; half natural size.

forms. It is so named from the character of the vertebræ, which, even in the cervical region, have their articular faces biconcave as in fishes. It is also characterized by having teeth set in distinct sockets. Its wings were well developed, and the scapular arch and bones of the legs conformed closely to the true bird type.

ICON'OCLASTS, image-breakers, the party in the early Christian Church that would not tolerate images, much less the adoration of them. At first images of martyrs and bishops were placed in the churches merely to keep their memory fresh, but latterly (in the 6th century) they began to be worshiped, lights being burned before them and incense offered in their honor. The eastern emperor Leo III. issued an edict in 726 ordering the people to abstain from the worship of such images, and soon after he decreed their destruction. This caused great commotion, and there arose two parties in the church, the image-worshipers and the iconoclasts or image-breakers, who each in turn persecuted the other. In 754 a council at Constantinople condemned image-worship; in 787 the second council of Nice (Nicæa) asserted and defined the doctrine. The controversy lasted over a century, coming to an end when, under the Empress Theodora, a council held at Constantinople (842) declared in favor of the worship of images among the Greeks, a decision which was confirmed by a second council, held 869–870, in the same place. In the western empire also images were at first retained only to preserve the memory of pious men, but the decision of the pope, which allowed the worship of images, finally prevailed in the western church.

I'DAHO, one of the United States on the western slope of the Rocky mountains, having Montana and Wyoming on the east, and Washington and Oregon on the west, Utah and Nevada on the south, and British Columbia on the north; area, 84,800 sq. miles. Idaho owes its rise and importance to its rich gold-fields, previous to the discovery of which, in 1860 and subsequently, it was inhabited only by Indians. The surface is largely mountainous, the highest summits rising to 12,000 and 13,000 feet. In the center of the state are the Salmon River mountains, to which belongs the picturesque and lofty Saw-tooth range. The chief rivers are the Lewis or Snake river and the Salmon river, the latter a tributary of the former, which again joins the Columbia. Along the course of the Snake river in the s.e. and s. is a desert tract 400 miles long by 40 to 60 broad. The climate is severe in the more elevated parts. The rainfall in the south is light but it increases toward the north and east where the elevated ranges arrest the moist winds. Agriculture is limited to the mountain valleys and to the basins of the large rivers. The mining industry has created a market for farm produce sufficient to justify irrigation and extensive farming. The soil being very fertile when sufficiently watered the yield of all crops is very large. Hay and forage is the most valuable crop, while that of alfalfa is very large. Wheat, oats, barley, and flaxseed are the most important cereals. Apples and prunes are the chief varieties of orchard fruit. There are 7,000,000 acres of timber land situated almost wholly in the northern part of the state; the Alpine fir, yellow pine and the red fir are the principal varieties. There are 25,000,000 acres of pasture land in the state and therefore grazing has been more extensively utilized than farming. Sheep, cattle, horses, and swine are raised. The Union Pacific passes through the southern part of the state and the Great Northern and Northern Pacific through the northern portion.

There are valuable forests, but they extend only over a small area. The scenery along the Salmon river in some places is grand, the stream flowing between perpendicular walls of rock from 500 to 2000 feet high. Gold has been found in many places, and there are also valuable silver mines. Coal, copper, iron, and salt are likewise found in many localities. The wild animals include the grizzly bear. The first white explorers of Idaho were Lewis and Clark. Early in the 19th century, a mission was established in 1842 at Cœur d'Alêne. In 1863 Idaho was organized as a territory with an area three times as large as at present including Montana and nearly all of Wyoming. In 1882 gold was discovered at Cœur d' Alêne which was followed by a large immigration. In 1889 a new constitution was adopted and in 1890 Idaho was admitted into the Union. At the head of the institutions of higher education is the University of Idaho at Moscow, the normal schools at Albion, and Lewiston and the agricultural and mechanical college at Idaho falls. In national elections Idaho has been carried by the democrats or the democrats and populists in fusion. In 1904 and 1908 it was carried by the Republicans. The mineral and other resources of the state has induced a rapid growth in population. Boise is the capital. Pop. 350,000.

IDAHO, University of, at Moscow, was founded in 1889, and opened for the reception of students in 1892. It offers free instruction to students of both sexes. It comprises a course of letters and science, schools of agriculture and applied science, and a preparatory school. It maintains an agricultural experiment station. Military drill is required of preparatory students, and of freshmen and sophomores in the university. The degrees of B.A., B.S., B.M., B.E.M., B.E.E., and B.C.E. are conferred.

IDEA, as a term in mental philosophy, has been used in various senses. Plato regarded ideas as the archetypes or original models of things, as existing from eternity and constituting the patterns according to which the deity fashioned the various things of which we become cognizant by our senses. According to Plato, ideas were independent of matter, and it was they that were the only objects of true knowledge. Aristotle opposed Plato's doctrine of independent ideas, but held the doctrine of ideas being types or patterns accompanying material things. By Descartes and many modern philosophers the word is employed to signify all our mental representations, all the notions which the mind frames of things. See also Idealism.

IDE'ALISM, the philosophical term which, in contradistinction to realism, expresses the view that subjective or ideal existence is not only the original but the only true being, and according to which there is allowed to sensible objects merely a phenomenal existence dependent upon the mind of a thinking subject. In modern times idealism has been maintained by Descartes, Berkeley, Kant, Fichte, Schelling, and Hegel.

IDEN'TITY, a person in point of law must often be proved in legal proceedings, as in proving a thief, etc. The usual proof is the oath of one who was cognizant of the facts at the time referred to. A common defense of persons accused of crime is that it is a case of mistaken identity, in which case the prisoner must usually prove an alibi—i.e. that he was in some other place at the time specified.

IDES, Latin Idus, with the Romans, the 15th day of March, May, July, and October. In the other months the 13th was the ides. The ides of March, on account of Cæsar's assassination having taken place on that day, was an ater dies or black day, and the senate was not allowed to sit. See Calendar.

IDIOM, a term used to denote a phrase or form of words approved by the general usage of a language, while in many cases it will admit of neither grammatical nor logical analysis. In a broader sense, it denotes the genius or peculiar cast of a language; hence it is often applied to a peculiar form or variation of a language, a dialect.

IDIOSYN'CRASY, a distinctive peculiarity of the mental or bodily constitution of any person, or that constitution or temperament which is peculiar to any person.

ID'IOT, a person who, from original defect, is almost destitute of intelligence, or in whom the intellect seems to be almost wholly wanting. In some cases the intellectual development is so low that there appears to be little more than a vegetative life. Others not quite so low in the intellectual scale recognize the persons with whom they live, are capable of being affected by certain emotions, understand a few questions, articulate a few words, and are able to take their own food, but are quite unable to do any kind of work. Those endowed with a little more intelligence may sometimes be employed in some kinds of labor which present no complicity or difficulty, but they are incapable of performing any intricate calculation or going through any long train of reasoning. The brain of idiots is sometimes sufficiently regular in its conformation, although in the great majority of cases there is something abnormal. The forehead is often depressed, receding, and flattened; sometimes the back parts of the head disproportionately large. The majority of idiots are of small stature and of weak constitution, rarely living beyond forty years. The causes of idiocy are not well known. It may be hereditary.

IDOL'ATRY, the worship of an image, object, or symbol as having in itself some divine or supernatural power, and being able in some way to respond to the worship paid to it, such images or objects being called idols; or the adoration of something merely natural as something supernatural and divine. Many have regarded idolatry as a declension from the one true God, and have seen in the various forms of heathen worship only more or less complete de-

gradations of an original revelation. Others see in idolatry an innate searching after God, and regard it as the first stage of human development, the necessary beginning of a knowledge of God. Idolatry may assume various forms; it may consist in a worship of the powers of nature, or of the heavenly bodies, or in animal worship, or in the worship of images representing mere fanciful and imaginary deities, or in the still lower fetichism.

IGNATIEFF, Nicholas Paulovitch, Russian soldier and diplomatist, born in St. Petersburg 1828. He served in the Crimean war, and was made a colonel 1856. In 1858 he was sent on a special mission to Bokhara and Khiva, and afterward as ambassador to Peking 1860. He was appointed minister at Constantinople 1864, and was envoy extraordinary 1867–78. He represented the party in favor of war, in opposition to Prince Gortschakoff. He was subsequently made governor-general of Irkutsk.

IGNEOUS ROCKS, in geology, rocks which are seen to owe their special character or structure to their materials having been once in a state of fusion, as lava, basalt, granite, etc. Such rocks are not stratified, and may occur in connection with sedimentary rocks of any age, having usually been forced up from below.

IGNIS FAT'UUS, a luminous appearance seen floating over marshy places at night, and sometimes, it is said, in churchyards. It is probably due to some gaseous mixture capable of igniting spontaneously, but it has never been satisfactorily explained. Other names are Will-o'-the-wisp and Jack-a-lantern.

IGUAN'A, a genus of lizards, the type of the family Iguanidæ, a native of Brazil, Guiana, and neighboring localities. It has an average length of about

Common iguana.

4 feet. Its food consists almost entirely of fruits, fungi, and other vegetable substances. Its head is large, the mouth wide Along the whole length of the back to the tip of the tail there is a crest of elevated, compressed, pointed scales; the lower part of the head and neck is furnished with a dew-lap or throat-pouch. The toes are furnished wth sharp claws, which enable it to climb trees with ease, while a rapid serpentine movement of its tail propels it swiftly through the water. Its usual color is dark olive-green. Its flesh is considered a delicacy, being tender and delicately-flavored, resembling that of a chicken. The eggs, of which the female lays from four to six dozen, are also eaten, having an excellent flavor. They are about the size of those of a pigeon, are laid in the sand, and hatched by the heat of the sun.

IGUAN'IDÆ, a family of lizards of which the iguana is the type. They have the body rounded, sometimes laterally compressed and furnished with a ridge or serrated crest along the middle line of the back from snout to tip of tail, sometimes a throat-pouch or dew-lap present.

ILLE-ET-VILAINE, a maritime department in the n.w. of France, lying between the English channel and the department of Loire-Inférieure. Rennes is the capital; St. Malo the chief seaport. Pop. 615,480.

ILLEGITIMACY, according to the civil and statute law as found in many states the status of children born out of wedlock. In New York the children of a man and woman cohabiting professedly as husband and wife have been held as legitimate. In most of the states upon complaint of the mother an inquiry may be had as to the identity of the putative father, and upon sufficient proof an order of affiliation made whereby the father is adjudged to pay for the support of the child. Under common law, an illegitimate child cannot inherit or transmit property. The legitimation of children born out of wedlock follows upon the intermarriage of the parents and acknowledgment of the children in most of the states.

IL'LINOIS (il'i-noi or -nois), one of the United States, bounded on the north by Wisconsin, east by Lake Michigan and Indiana, southeast by Kentucky, from which it is separated by the Ohio, and west by the Mississippi, separating it from Missouri and Iowa; greatest length, 370 miles; greatest breadth, 160; area, 56,650 sq. miles. The surface is somewhat hilly near the Ohio, and undulating toward the west; and a range of bluffs runs for a considerable distance along the margin of the Mississippi; but with these exceptions the state is one continuous plain, with a gentle inclination toward the southwest, and with the exception of Louisiana and Delaware is the most level state of the Union. It has a greater proportion of arable land than any other state. The only part of the state thickly wooded is the extreme south portion. The chief rivers are the Illinois, which traverses the state diagonally northeast to southwest, Rock, Kaskaskia, and Wabash. Indian corn and wheat are the chief objects of cultivation, but rye, oats buckwheat, potatoes, turnips, cotton, hemp, flax, tobacco, castor-beans, etc., are also produced, and the cultivation of the vine is making considerable progress. The common domestic animals are abundant, and immense numbers of swine are reared on the mast of the forests. Lead is found in vast quantities, and the ore (argentiferous galena) contains a considerable percentage of silver; the metal is found chiefly near the Wisconsin frontier, Galena being the center of the mining district. Bituminous coal abounds, and is raised in considerable quantities, and several valuable salt springs are found in the east and south. The rocks mostly are limestone, gypsum, and sandstone. The climate, although somewhat humid, is generally healthy; the winters being severe owing to the northerly winds which have an unobstructed sweep over the prairies. Illinois is the most important manufacturing state west of the Alleghany mountains and is surpassed by only two states in the Union: New York and Pennsylvania. It is the collecting and distributing center for the west and northwest. Chicago produces 70 per cent of the total manufactured product of the state. It is the most important stock market and

Seal of Illinois.

is the greatest slaughtering and meat packing center of the world. Only two states exceed Illinois in the manufacture of steel and iron and the value of its agricultural implements is more than three times that of any other state. Pennsylvania alone exceeds Illinois in the manufacture of cars and other railroad supplies. The railroads are more numerous and have a greater extent of track than any other state. The state has water communication with the Mississippi valley and a southern outlet to the Atlantic. Lake Michigan, which touches the state at the northeast corner gives water communication with Canada and an eastern outlet to the Atlantic. The Illinois and Michigan canal connects Lake Michigan at Chicago with the Illinois at LaSalle (distance 96 miles), and enables vessels of some size to pass from the Gulf of Mexico to the St. Lawrence. There is a well-organized school system. At the head of the institutions of higher education are the University of Chicago, which has attracted attention by its original features and the eminence of the scholars who have been called to fill its chairs: the University of Illinois at Urbana, the Northwestern university, the Armour school of technology, Rush medical college, all situated at Chicago, Knox college at Galesburg, Illinois and Wesleyan university at Bloomington. Father Marquette in 1673 ascended the Illinois river and LaSalle entered the river in 1679 and named it from the tribe of Indians inhabiting the region. French traders established themselves at Kaskaskia, Cahokia, and other Indian villages between 1683 and 1690. There were six important settlements by 1751. In 1778–79 a force of Virginians, under George Rogers Clark, captured Kaskaskia and subdued the province. Virginia ceded its claims to the southern part of the region in 1784, Massachusetts and Connecticut in the following year, and in 1787 the region became part of the northwest territory. In 1800 Ohio, in 1802, Indiana and in 1805 Michigan were set apart and the remainder was organized in 1809 as the Illinois territory. In 1812 the garrison at Fort Dearborn (Chicago) was massacred. In 1818 the first constitution was adopted and Illinois was admitted to the Union. The

Illinois and Michigan canal was begun in 1834 and was built with the proceeds of the sale of public lands. In 1850 congress made an extensive cession of public lands to aid in the construction of the Illinois Central railroad, an enterprise which added greatly to the development of the state. In 1858 the great contest for the United States senatorship took place between Stephen A. Douglas and Abraham Lincoln. The state furnished 260,000 men as its quota of troops during the civil war. In 1871 a large part of Chicago was laid waste by fire and over 100,000 people were made homeless. The loss was estimated at $300,000,000. In 1885–6 owing to a general feeling of unrest bitter and bloody strikes took place; in Chicago an anarchist crowd attacked the police with dynamite, killing and wounding a large number. In 1892 the Chicago drainage canal for the removal of Chicago's sewage was started. In 1893 the Columbian World's Fair was held in Chicago. In 1894 a strike of the Pullman palace car company participated a general strike of railway employees. Interference with the United States mails led to the intervention of the Federal government. In national politics Illinois was democratic before 1860 and since that year with the exception of 1892, when it voted for Grover Cleveland, it has been consistently republican. Springfield is the capital. Pop. 5,391,300.

IL'LINOIS, a river in the United States, formed by the union of the Kankakee and Desplaines, in the n.e. part of the state of Illinois. It flows thence s.w., and falls into the Mississippi about 20 miles above the mouth of the Missouri. It is 500 miles long, half of it being navigable. A canal connects the river with Chicago. See above article.

ILLINOIS, University of, the State University of Illinois, between the cities of Urbana and Champaign, was chartered in 1867 as the Illinois industrial university, and assumed its present name in 1885. The university is divided into six colleges: literature and arts, science, engineering, agriculture, law and medicine, including schools of library and science, art and design, music, military science, and pedagogy, and preparatory and graduate departments. The state laboratory of natural history and the United States agricultural experiment station for Illinois are departments of the university, but have separate financial support. The schools of pharmacy, medicine, and dentistry are situated in Chicago.

ILLITERACY, the condition of one who cannot read and write his own language. As used in the United States census, the term includes all those who can read but not write.

The report of the United States commissioner of education for 1900 contains the following table for the different countries:

	Per cent.		Per cent.
Germany	0.11	Hungary	28.10
Switzerland	0.30	Greece	30.00
Scotland	3.57	Italy	38.30
Holland	4.00	Russia	61.70
France	4.90	Spain	68.10
England	5.80	Portugal	79.00
United States	10.70	Servia	86.00
Belgium	12.80	Rumania	89.00
Ireland	17.00	Austria	23.80

ILLYR'IA, Illyr'icum, a name formerly rather loosely applied to a large tract of country on the east side of the Adriatic, the ancient Illyrians being the ancestors of the modern Albanians.

ILOCOS NORTE (ē-lō'kōs nōr'tā), a Philippine province occupying the northwestern corner of the island of Luzon. Its area is 1873 sq. miles. The principal river being the Pagsan or Laoag, and the valleys are very fertile, producing grains and fruits, a fine quality of rice, good cotton and tobacco, and sugar. Iron ore is abundant. Pop. 156,700.

ILOCOS SUR, (sōor), a Philippine province, situated in the northwestern part of the island of Luzon. It is crossed by the large river Agra, and a number of smaller streams; the soil is very fertile, producing indigo, sugar, and cocoanuts, Pop. 172,836. The capital is Bigan.

ILOILO (ē'lō-ē'lō), a province comprising the southern half of the island of Panay in the Philippines and about thirty, mostly small, outlying islands, one of which, however, Guimaras, is 30 miles long by 10 miles wide. The area of the province is 2600 sq. miles, and its population 472,798. The level lands, which constitute the greater part of the area of the province, are very productive all kinds of tropical fruits flourishing; but the inhabitants are chiefly given to the cultivation of sugar and tobacco.

ILOILO, the capital of the province of Iloilo, situated on the southeastern shore of the island of Panay, on the strait separating Guimaras island from the mainland. It has an excellent harbor, and is, next to Manila, the chief commercial center of the Philippines. Its chief exports are sugar, tobacco, rice, coffee, and dyewoods. Pop. 10,400.

ILO'RIN, a town in West Africa, Nigeria, about 150 miles n.e. of the Bight of Benin in Nupe, a great center of trade; pop. 150,000, mostly Mohammedans.

IMAGE, in optics, the spectrum or appearance of an object made by reflection or refraction. It is by means of optical images that vision is effected, or that the telescope and microscope are of use. See the articles Optics, Eye, etc.

IMAGINATION, literally that faculty of the mind by which we can form mental images of things. Besides the power of preserving and recalling such conceptions, the imagination has the power to combine different conceptions, and thus create new images or mental pictures. It is this faculty which is more strictly termed imagination. In the creation of new images, or more properly in the combining of images which have previously been derived from objects of perception, the imagination operates according to the laws of the association of ideas. Its operations are nevertheless not wholly independent of the will, for by directing the attention to some leading thought, the will can determine the limits within which the laws of association are to act. Such free and yet regulated action of the imagination alone can give birth to the productions of the fine arts.

IMBECILITY, weakness of mind, such as puts a person considerably below the general run of mankind, but is not so great as to be called actual lunacy or idiocy, nor so well marked perhaps as to be classed under any one of the forms of insanity. Imbeciles sometimes display a considerable amount of intelligence in certain directions, and are often very cunning. They may be interesting, amusing, and even useful members of a community. In the United States there are no special legal provisions in regard to imbeciles. As a general rule the court is ready to support the obligation of any contract that a person of weak mind has entered into, unless it is of such a nature that a person of sound mind would not have agreed to it, or unless there is suspicion of fraud. An imbecile person may be summoned as a witness, but the degree of credulity attaching to his evidence naturally depends very much on the amount of intelligence he displays, and on the nature of the circumstances regarding which his evidence is offered.

IMMACULATE CONCEPTION. See Conception (Immaculate).

IMMERSION, in astronomy, the disappearance of one heavenly body behind another or into its shadow. Immersion occurs at the beginning, and emergence at the end of an occultation or an eclipse.

IMMORTALITY, exemption from death; the state of everlasting life. The dogma of the immortality of the soul is very ancient. It is connected with almost all religions, though under an infinite variety of conceptions. By the immortality of the soul we understand the endless continuation of our personality, our consciousness, and will. There are so many reasons to render immortality probable, that with most nations the belief is as clear and firm as the belief in a god; in fact the two dogmas are intimately connected in the minds of most men. The hope of immortality must be considered a religious conviction. Reason and religion command man to strive for continued perfection. This duty man cannot relinquish without abandoning at the same time his whole dignity as a reasonable being and a free agent. He must, therefore, expect that a continuation of his better part, as the necessary condition of his progress in perfection, will not be denied to him. Hence the belief in immortality becomes intimately connected with our belief in the existence and goodness of God. Among rude peoples the life after death is usually regarded as a state of being not essentially different from the present —one in which the hunter shall renew his chase, and his corporeal senses shall have their accustomed gratifications. Among the ancient Greeks and Romans the spirits of the dead were believed to live in the other world as a sort of shadows, and the life after death was also considered as a shadow of the present. Among some peoples the imagination attributes changes of condition to the future life, and the doctrine of transmigration, or the progress of the mind or soul in different stages, is developed. Connected with the belief in the immortality of the soul is the belief in a state where souls are purified after death, as existing among the Egyptians and many Christians. See Purgatory, Soul.

IMMORTELLES, a name for flowers, also known as everlasting flowers, and often made into wreaths for adorning graves.

IMPALEMENT, the putting to death by thrusting a stake through the body. This manner of inflicting death was known to the Romans, though not practiced by them. It is still practiced in some half-civilized countries.

IMPAN'EL, to form a jury by entering the names on the roll or impanel. See Jury.

IMPEACHMENT, an accusation and prosecution for a crime or misdemeanor, in which the House of Commons are the prosecutors and the House of Lords the judges. The necessity of some tribunal distinct from the ordinary courts, for the trial of certain offenses, or for any high misdemeanor in certain officers, is apparent, since the judges of the highest courts cannot in all cases safely be intrusted with the trial of each other. Impeachment is, however, seldom used, the last instance being that of Lord Melville in 1805. After sentence, the crown may pardon the offender. The question of guilty or not guilty is decided by a majority of votes.—In the United States the procedure is similar to that of England, the house of representatives being the accusers and the votes of two-thirds of the senate being necessary for a conviction.

IMPENETRABIL'ITY, in physics, that property of matter which prevents two bodies from occupying the same space at the same time; or that property of matter by which it excludes all other matter from the space it occupies.

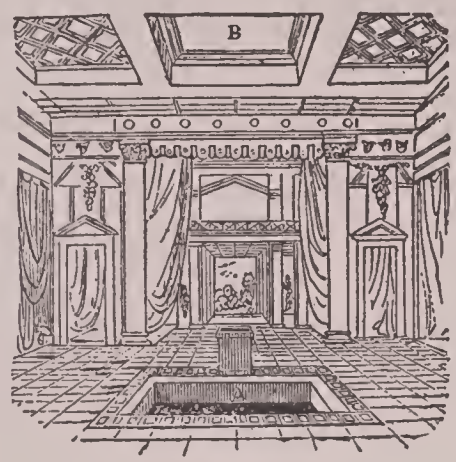
IMPERA'TOR, among the ancient Romans, a term originally applied to a military commander, one who held the imperium, or military power. In later times no one received this title who had not defeated a hostile force of at least 10,000 men. After the overthrow of the republic imperator became the highest title of the supreme ruler, and acquired the signification which we attach to the word emperor. It was still given, however, to triumphant generals, and, in this case, has its old signification. The emperors appear to have used it because they were considered as superior to all the generals. See Emperor.

IMPERIAL, pertaining to an emperor or empire; thus, the imperial parliament is that of the United Kingdom. A size of paper 30 in. by 22, is called imperial.

IMPERIALISM, a term given to that form of government known as an empire and connoting absolute power in the hands of a single ruler. The term lately has been used to describe the policy of various nations of establishing world powers through the extension of their rule over other and especially inferior races. In the United States at the close of the Spanish American war a group of citizens who vigorously opposed the acquistion of the Philippines and Porto Rico became known as anti-imperialists.

IMPEY PHEASANT, a bird of the pheasant family remarkable for its splendid plumage. It is found in the higher regions of the Himalayas, and is of the size of a small turkey. Lady Impey attempted (unsuccessfully) to introduce the bird into Europe, hence the name.

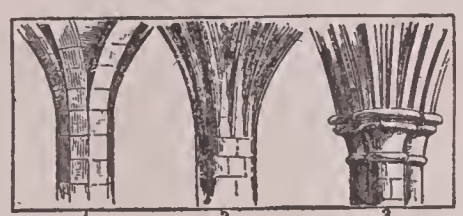
IMPLU'VIUM, in ancient architecture a term which denoted, in the houses of the ancient Romans, a basin in the



Roman atrium.
A, Impluvium; B, Compluvium.

middle of the atrium or entrance-hall, below the compluvium or open space in the roof, to receive the rain. See Atrium.

IM'POST, (1) a tax, tribute, or duty, particularly a duty or tax laid by government on goods imported. (2) In architecture, the point of junction between an arch and the column, pier, or wall on which it rests. It is often marked by horizontal mouldings, though these may be absent. Imposts have received various names, according to their



Imposts.
1, Continuous. 2, Discontinuous. 3, Shafted.

character. Thus, a continuous impost is where the mouldings are carried down a pier; a discontinuous impost where there are no mouldings, but the pier is of a different section from the arch; shafted imposts are where the arch mouldings spring from a capital and differ from those of the pier.

IMPOUNDING CATTLE. See Pound.

IMPRESSMENT OF SEAMEN, the act of compelling persons, especially seafaring men, to serve in the English navy. The power of impressing seamen, though still existing, has fallen into abeyance since the conclusion of the general war of 1815. Impressment was of ancient date, and uniformly practiced throughout a long series of years. It is also recognized in many statutes, such, for instance, as exempted certain persons from impressment, though the power of impressing is not expressly granted in any acts of parliament.

IMPRIMA'TUR (Latin, "let it be printed"), the word by which the licenser allows a book to be printed in countries where the censorship of books is exercised in its rigor.

IMPRISONMENT, the restraint of a person's liberty, whether in a prison, the stocks, or by merely keeping in custody. It is usually inflicted by way of punishment, the power of sentencing to imprisonment being conferred on certain courts or magistrates, and stricty limited by law. A person may be imprisoned, however, who is merely accused of a crime, in which case he can demand to be released on bail. Imprisonment for ordinary debt is now practically abolished.

IMPUTA'TION, as a term in Christian theology, is used to signify, on the one hand, the reckoning of the sins of man to Christ, and, on the other hand, the reckoning of the righteousness of Christ to believers.

INCA, or **YNCA,** a word signifying "chief," which the natives of Peru gave to their kings and princes of the blood before the Spanish conquest. See Peru.

INCANTATION, a certain formula of words, supposed to have some magical effect, especially if uttered with the accompaniment of certain ceremonies. Incantations are still common as a part of popular medicine among the negroes and Indians of this country and also among the uneducated of all countries and among barbarous peoples generally.

INCARNATION, a word used to express the manifestation of the deity in the flesh under the human form; thus we speak of the incarnation of Christ. The Hindus believe in innumerable incarnations of their deities. The most celebrated are the nine incarnations of Vishnu.

IN'CENSE, aromatic substances burned in religious rites on account of the sweet odor they emit. The custom of burning incense is ancient and widely spread. Among the Jews the practice was enjoined as part of the worship of the sanctuary (Ex. xxx. 27), the ingredients of the incense also being laid down, and it was to be burned on a special altar called the altar of incense. This altar was made of acacia (shittim) wood, and was overlaid with gold, hence it was also called the golden altar, as distinguished from the altar of burnt-offering, which was made of brass. The incense was burned daily—morning and evening. In ancient Egypt, Assyria, Babylonia, India, Greece, and Rome incense-burning was part of the worship of the gods, and it is still employed as part of the Buddhist ceremonial. Both the Greek and the Latin churches use incense in worship, but the practice cannot be shown to have existed among Christians till after the first four centuries. Among Catholics it is used at every high mass, at consecrations of churches, in processions, funerals, etc. In the English Church it is only employed by the high ritualistic section, but its use has never been prohibited.

IN'CEST, sexual intercourse within the prohibited degrees founded on the Levitical code, and include degrees both of consanguinity and of affinity. (See Leviticus, chap. xviii.) In England incest is an ecclesiastical offense, and is left to the jurisdiction of the spiritual courts. In Scotland and some of the United States it is a criminal offense.

INCLINATION, Magnetic, or Magnetic Dip. See Dipping Needle.

INCLINATION COMPASS, same as Dipping Needle.

INCLINED PLANE, a plane forming with the horizontal plane any angle whatever excepting a right angle. It is one of the mechanical powers by which a small force under certain conditions is used to overcome a greater force. When a body lies on an inclined plane part of its weight is supported, so that if a cord be fastened to it and pulled, a force less than the weight of the body acting in a direction parallel to the plane will prevent it from sliding, or will move it up the plane. Thus a heavy wagon is raised on an inclined road by a horse which would be quite unable to exert a pull equal to a quarter of the weight of the wagon. Neglecting friction, the force parallel to the plane necessary to raise the body is equal to the weight of the body multiplied by the vertical height through which it is lifted, divided by the distance it is moved along the plane.

INCOMBUSTIBLE CLOTH, cloth rendered uninflammable by artificial means. This may be done by steeping the fabric in borax, phosphate of soda or ammonia, alum or sal-ammoniac; but these salts are not suitable for fine fabrics, and that which has been found to answer the purpose most effectually is tungstate of soda. A solution containing 20 per cent of this salt, along with 3 per cent of phosphate of soda, renders a fabric perfectly non-inflammable, and does not interfere with the ironing.

INCOME TAX, a tax levied directly from income of every description, whether derived from land, capital, or industry.

INCOMMEN'SURABLE, in mathematics, a term applied to two magnitudes when they cannot both be measured by the same quantity, that is, when they do not contain it one or more times exactly. The diagonal and side of a square are an example.

INCUBATION (pathology), the period between the introduction of the morbific principle and the outbreak of the disease. It is then gathering head in the system, and indicated only by such general symptoms as loss of appetite or sleep, etc. In epidemic and contagious diseases the period of incubation is well defined.

INCUBATION, the mode in which birds commonly bring forth their young, that of sitting on the eggs till they are hatched by the natural heat of the body. In general it is the female which undergoes the labor of incubation, but among some species, chiefly of monogamous birds, the male relieves the female while she seeks her nourishment; in others the male feeds her. Some birds, like the cuckoo, abandon their eggs to be hatched by others. In a state of nature birds generally commence to sit in spring. The time of incubation varies with different species, but is always the same with the same species. In the hummingbirds it is 12 to 14 days; in the swallow and lark 15; the canary, from 15 to 18; crow, 20; common hen, 21; pheasant, partridge, etc., 22; peacock and turkey, 30; swan, 40–45; cassowary, 62.

INDEM'NITY, a term frequently employed in politics and jurisprudence. It is used in various significations, but is usually applied to an act of the legislature passed for the purpose of relieving individuals, especially in an official position, from the penalties to which they may have rendered themselves liable by some violation of the law whether by act or omission or in case of members of government in consequence of exceeding the limits of their strict constitutional powers.

INDEPENDENCE, Declaration of, See Declaration of Independence.

INDEPENDENCE DAY, fourth day of July, the United States national holiday.

INDEPENDENCE HALL, a brick building in Philadelphia, built in 1729–34. In it the continental congress met, Washington was made commander-in-chief of the American army in 1775, and the declaration of independence was adopted on July 4, 1776, and read to the people assembled in the street. It is now a museum of revolutionary and historical relics.

INDETERMINATE, in mathematics, having an indefinite number of values or solutions. Indeterminate analysis is a branch of algebra in which there are always given a greater number of unknown quantities than there are independent equations, by which means the number of solutions is indefinite.

INDEX LIBRORUM PROHIBITORUM ("list of prohibited books"), in the Roman Catholic Church, a title used to designate the catalogue or list of books prohibited by ecclesiastical authority, on account of the heretical opinions supposed to be contained in them, or maintained by the authors or editors of them: when the list or catalogue is of books allowed to be read after correction or alteration, agreeably to the orders of the papal authorities, it is termed Index Expurgatorius. Such prohibitory catalogues have been in use from a very early period in the history of the church, commencing with a list of prohibited books drawn up by a council held at Rome in 494, or even earlier with the proscription of the writings of Arius. These prohibitions, in fact, were often issued by other than the papal authorities. In 1408 a synod at London prohibited the reading of the books of Wickliffe. The most important editions are those of Alexander VII. in 1664, and of Benedict XIV. in 1758. The latest edition appeared in 1881, with a supplement in 1884.

INDIA, a name properly applicable to the whole of the British Indian Empire, which includes Burmah, but popularly restricted to the great central peninsula of Southern Asia. Its length north and south, and its greatest breadth, east and west, are both about 1900 miles. Within these borders is an area of about 1,300,000 sq. miles, with a population of about 295,000,000. India may be regarded as consisting of three separate regions, well defined by differences of soil, climate, productions, and population. The first is the region of the Himalayas. Immediately south of the Himalayas lies the vast North Indian plain, containing the most fertile and densely-populated portions of the empire. South of the northern plain rises the third region of India, the triangular plateau of the Deccan, which has a general elevation of from 2000 to 3000 feet. Its northern scarp is formed by a number of hill ranges known as the Vindhya mountains. The other two sides of the Deccan are formed by the Eastern and Western Ghâts, which stretch southward along the eastern and western coasts of India, the latter rising in the Nilghiris or Neilgherries to the height of 8760 feet. The vast North Indian plain is watered by three distinct river systems, which collect the drainage of both the northern and southern slopes of the Himalayas. The Ganges for thousands of years has occupied a prominent place in Indian civilization, and was the sole channel of traffic between Upper India and the seaboard until the opening of the railway system in 1855. The Indian rivers in the lower portions of their courses afford a natural system of irrigation, but in the higher parts an extensive system of canal irrigation is required. The Ganges and Jumna canals alone irrigate an aggregate area of about three million acres. The coasts of India have very few indentations, and consequently few good natural harbors. There are no lakes of any extent, Chilka and Kolair on the east coast being the largest.

In Southern India the climate, of course, is tropical, and generally the heat is very great. Among the highest elevations of the Himalayas an Alpine climate prevails. The Indian plains are, especially in summer, sultry, unhealthy, and partly barren. The Deccan and the slopes of the Himalayas enjoy a temperate climate. The climate of the Nilghiris is healthy and pleasant, and several sanatoria for Europeans have been established there, as well as on the Himalayas. Throughout the entire country there are only two annual seasons, the dry season and the rainy season. The rainfall depends upon the monsoons. On the western coast the rainy season begins with the southwest monsoon, and lasts from May till November; on the east coast the rainy season, following the southeast monsoon, lasts from November till March. The rainfall, however, is distributed with great irregularity.

The flora of India offers nothing very distinctive. Many plants of temperate climates, such as wheat, barley, European vegetables, etc., are grown in the northwestern and other parts, while various products of warmer regions are also cultivated, such as cotton, rice, indigo, oil-seeds, jute, tobacco, sugarcane, cocoanut, date, and other palms, spices, etc. Coffee, tea, and cinchona are now extensively cultivated, the first particularly on the slopes of the western Ghâts and in the Nilghiris. The tea-plant is also grown in the south, but especially in Assam and along the lower slopes of the Himalayas. European fruits abound, and among cultivated fruits may be mentioned the mango, plantain, pomegranate, citron, orange, lime, melon, fig, almond, pineapple, guava, jack, and tamarind. Among trees the teak forests under the protection of the government are of most economic value. The bamboo, the

banyan, the sappan, the saul, etc., are all characteristic of Indian forest scenery. Opium is cultivated in Bahar, Benares, and Malwa. The vast forests of India are tenanted by great numbers of wild animals, birds, and reptiles. Large herds of elephants are still met with in Nepaul, Eastern Bengal, and the Nilghiris; the bear, the wild boar, and rhinoceros chiefly in the woods of the Eastern Himalayas; the tiger is found in every part of the country; the lion is now almost extinct. Other carnivorous mammals are the leopard or panther, cheetah, wolf, fox, jackal, and hyena. Several antelopes and deer, wild sheep and goats, the wild ass, the great gaur ox or "bison," the wild buffalo, are among the fauna. Snakes and reptiles in all varieties are very numerous, and the cobra and other snakes cause numerous deaths. Among domestic animals are oxen, camels, horses, mules, sheep, and goats. Of birds, eagles, vultures, the peacock, parrakeets, the adjutant-bird, etc., are characteristic species. Fish are plentiful and in great variety.

India is richly endowed with minerals; hardly a single metal seems to be wanting; but they are not worked to any extent. Coal, iron, gold, and salt receive most attention.

In 1858 the administration of the British possessions in India was transferred from the East India company to the crown, and in 1877 the British queen assumed the title of Empress of India. The country has long been divided into the three presidencies of Bengal, Madras, and Bombay; but the first of these was latterly subdivided into several provinces, and its name has now little or no administrative significance. The lieutenant-governors, chief-commissioners, and other officers at the head of the various divisions are subordinate to the governor-general or viceroy, representing and appointed by the crown, but each has a large measure of independence. The governor-general in council has power to make laws for all persons within the Indian territories under British rule, and for all subjects of the crown within the allied native states. He acts under the orders of the secretary of state for India, who is assisted by a council of fifteen and is always a member of the British cabinet. In India the supreme executive and legislative authority is vested in the governor-general, the capital being Calcutta. There are also a number of native or feudatory states, the relations of which to British rule are somewhat varied. Their area is 679,393 sq. miles, and their population 62,461,549. Among the most important of such native states are Haidarabad, Cashmere, Mysore, Travancore, Baroda, Gwalior, Indor, Jeypore, and Jodhpore.

The total European and native army numbers 220,000, the native army (146,000) being officered by Europeans. The armies of the feudatory or independent states of India number 350,000 men.

The chief source of revenue is the land-tax, which yields from $90,000,000 to $100,000,000 annually. About 70 per cent of the population are engaged in cultivating the soil, while only about 3 per cent reside in towns of over 50,000 inhabitants. Opium, which forms a government monopoly, and salt, on which a considerable duty is levied, are the other two important sources of revenue. The chief money denomination is the rupee, which is divided into 16 annas, the anna again being equivalent to 4 pice. The primary standard of weight, called the ser, is equal to the French kilogramme, or 2.205 lbs. A weight in common use is the maund, in Bengal 82 lbs., in Bombay 28 lbs., in Madras 25 lbs. By an act passed in 1889 the imperial yard is made the standard measure of length.

Some of the irrigation canals as well as the rivers supply means of internal navigation, but the construction of railways has been the most important step taken to render the internal communications of India permanently efficient. The total railway mileage open for traffic in 1900 was nearly 23,000 miles. There is an extensive system of posts and telegraphs, the length of telegraph lines being 45,000 miles.

The early history of India is obscurely written in the myths of Sanskrit literature, but the first fact of any certainty is that about the year 2000 B.C., or even earlier, an Aryan people of comparatively high civilization descended from the mountain regions of the northwest into the plains of India and subdued the original inhabitants there. The expedition of Alexander the Great to the Indus in B.C. 326 gives us a momentary glimpse of that part of India; but between his invasion and the Mohammedan conquest there is little authentic political history of India. In the 3rd century B.C. Buddhism was established throughout India, but it afterward entirely gave way to Brahmanism. The first six centuries of the Christian era were occupied by struggles between the native dynasties and invaders from the northwest. In the 8th century the tide of Mohammedan conquest began with Kasim's advance into Sind (711 A.D.). But the Mohammedans were again driven out in 828, and for more than 150 years afterward the strong feudal and tribal organizations of the northern Hindu kingdoms were a barrier to the Musselman advance. At length in the year 1001 Mahmud of Ghazni reduced the Punjab to a province of Ghazni, and the Mohammedan power was gradually extended into Southern India. In 1398 Timur or Tamerlane led a great Mogul (or Mongol) invasion of India, and after sacking Delhi retired into Central Asia. In 1526 Sultan Baber, a descendant of Tamerlane, founded the Mogul Empire in India. His grandson Akbar reigned from 1556 to 1607, and extended his power over most of the peninsula, being distinguished by his justice and his tolerance in matters of religion. His son Jehanghir received an ambassador from James I. in 1615. During the reign of his successor, Shah Jehan, famous for his architectural magnificence, the Mahrattas began to be formidable in Southern India. Shah Jehan was deposed in 1658 by his youngest son Aurengzebe, who made war successfully with the Afghans, the Rajputana tribes, and the rising power of the Mahrattas. The Sikhs, a Hindu sect, formed a religious and military commonwealth in the Punjab in 1675. On the death of Aurengzebe in 1707 the Mogul empire began to decline.

The English early came into collision with the French in India, whose first settlements were founded in 1604. The first conflict with the French took place in 1746, when the English lost Madras, which was, however, restored by the treaty of Aix-la-Chapelle. In 1751 Dupleix, the French governor at Pondicherry, was powerful enough to place creatures of his own on the thrones of the Deccan and the Carnatic. The English supported rival candidates, and the result was a second war, which left English influence predominant in the Carnatic, though the French still controlled the Deccan. The most memorable incident in this war was Clive's capture of Arcot. About this time important events took place in Bengal, then a subordinate presidency to that of Madras. The Nawab of Bengal, Siraj-ud-Daula (Surajah Dowlah), attacked the English settlement at Calcutta with a large army, forced it to capitulate, and thrust the prisoners, to the number of 146, into the Black Hole or common prison of the garrison, a room 18 feet square, with two small windows. After a night of unparalleled suffering only twenty-three were found alive in the morning. Clive was at once sent with an armament from Madras, recovered Calcutta, attacked and took the French settlement at Chandernagore, routed the Nawab's army at the battle of Plassey (23d June, 1757), and placed Mir Jaffier on the viceregal throne, with consent of the Mogul court. In the south the English were equally victorious. A force despatched by Clive took Masulipatam, and the victory gained by Coote at Wandawash on 22d January, 1760, completed the destruction of the French power in India.

The system of double government established by Clive was abolished in 1772 by Warren Hastings, who appointed English officers to collect the revenues and preside in the courts, and thus laid the foundations of the present system of British administration in India. In 1774 Hastings was made governor-general of India. In 1786 Lord Cornwallis succeeded Hastings as governor. His rule is memorable chiefly for the war with Tippoo Sultan of Mysore, which terminated in the sultan having to surrender one-half of his dominions to the British and their allies. Sir John Shore succeeded as governor-general in 1793. He was followed by the Marquis of Wellesley, who arrived in 1798, and whose policy eventually made the British power paramount from the Himalayas to Cape Comorin. Under him Tippoo of Mysore was completely overthrown (1799) and the second Mahratta war successfully concluded, Sir Arthur Wellesley (latterly Duke of Wellington) having won the victory of Assaye (23d Sept. 1803), and General Lake that of Laswaree (1st Nov. 1803). In 1838 the Afghan war broke out, and terminated in the disastrous British retreat. (See Afghanistan.) In 1849, the Punjab was annexed to the British

INDIA

SCALE OF MILES
0 50 100 200 300 400

Railroads .....
Submarine Cables .....
Canals .....

Size of type indicates relative importance of places

Hammond's 8 x 11 Map of India
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Longitude East from Greenwich

dominions. This was immediately followed by the Burmese war, ending in the annexation of Pegu, 20th June, 1853. The Indian states of Sattara, Jhansi, and Nagpur were, on the failure of the native succession, annexed to the British possessions, 1852–56, and Oudh also brought directly under British rule.

The administration of Viscount Canning (1856–61) was distinguished by a short war with Persia, and especially by the great Sepoy mutiny. Several outbreaks among the native soldiers took place during March, 1857. The first formidable revolt, however, was at Meerut on 10th May, where the Sepoys of the 3d light cavalry, assisted by the 11th and 20th regiments of infantry, rose and massacred the Europeans. At Cawnpore the revolted Sepoys were headed by Nana Sahib, the heir of the last Peshwa of the Mahrattas. After a heroic but fruitless attempt to defend themselves, the Europeans capitulated on the sworn promise of Nana Sahib to allow them to retire to Allahabad. On the 27th the survivors, about 450 in number, were embarking when they were attacked by the Nana's troops, and the men indiscriminately massacred. The women and children, 125 in number, were carried back to Cawnpore and kept till the 15th of July, when they were all cut to pieces on the approach of Havelock's army. Cawnpore was stormed the day following.

In 1858 the direct sovereignty of India, and the powers of government hitherto vested in the East Indian company, were vested in the British crown. In 1877 Queen Victoria was proclaimed Empress of India at Delhi. In 1877–78 another disastrous famine occurred, and despite the most strenuous efforts of the government over five million persons are said to have perished. In 1878 the intrigues of Shir Ali, amir of Afghanistan, with Russia, led to a declaration of war on the part of the British. After two campaigns Abdurrahman Khan was established on the Afghan throne by British arms. In 1880 Lord Ripon succeeded as viceroy; being followed in 1884 by Lord Dufferin, under whose rule took place the annexation of

Insignia of the Order of the Star of India.

Upper Burmah on January 1, 1866. He was followed by the Marquis of Lansdowne, the Earl of Elgin, the Viscount Curzon, and the Earl of Minto.

INDIA, Orders of Knighthood in, consist of The Most Exalted Order of the Star of India, instituted in 1861, and comprising the Viceroy of India as Grand Master, and a number of Knights Grand Commanders (G.C.S.I.), Knights Commanders (K.C.S.I.), and Companions (C. S. I.); The Most Eminent Order of the Indian Empire, instituted 1st Jan. 1878, and comprising the Viceroy of India as Grand Master, a number of Knights Grand Commanders (G.C.I.E.), Knights Commanders (K.C.I.E.), and Companions (C.I.E.); and The Imperial Order of the Crown of India, instituted 1st Jan., 1878, and comprising the Princess of Wales and the princesses of the royal-blood, and other British and Indian ladies.

INDIANA, one of the United States, is bounded on the east by the state of Ohio, on the south by the Ohio river; on the west by Illinois; on the north by the state of Michigan and Lake Michigan. The extreme length of the state is 276

Seal of Indiana.

miles, with an average breadth of 145 miles; and the area is 33,809 sq. miles.

Indiana occupies a table-land, gently undulating, except along the Ohio. There are no mountains or mountain ranges. With the exception of a small portion, the whole state inclines toward the southwest. The mean altitude of the state is estimated at 735 feet above sea-level. It is well watered. The Wabash is the largest river, and, with its branches, it drains three-fourths of the surface. The country south of the Wabash was originally covered with heavy forests of oak, beech, maple, walnut, ash and other hard woods; north of that river was principally prairie, interspersed with small lakes.

The coal-measures occupy over 7000 sq. miles in the western and southwestern parts, furnishing workable seams, at a depth of 50 to 220 feet; the seams vary in thickness from two and a half to eleven feet; an area of 600 sq. miles in this field yields a superior "block" or splint coal. This is used in blast furnaces without coking, and is well adapted for the preparation of Bessemer steel. Natural gas has been discovered and utilized as a fuel and illuminating agent in various portions of the state and the supply is apparently very great.

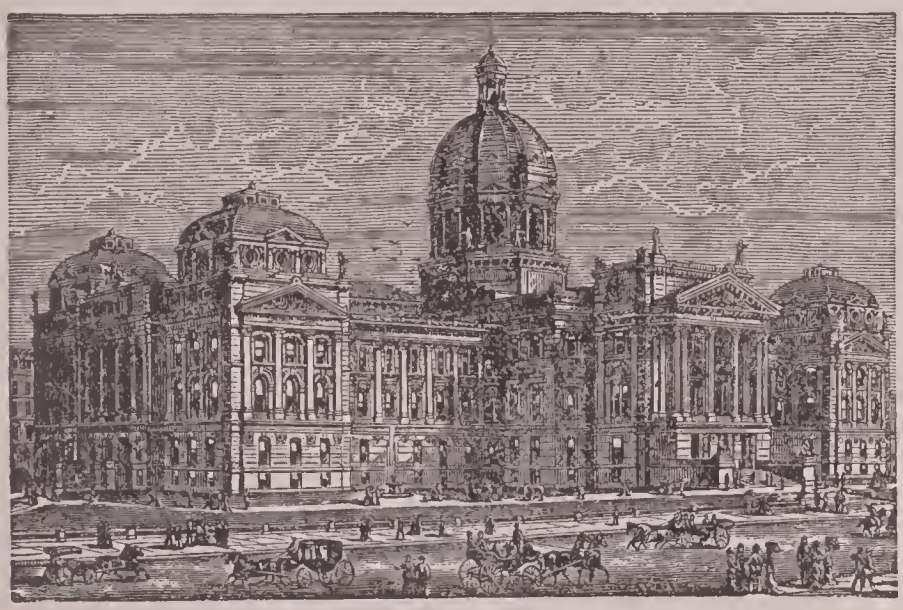
Inexhaustible beds of fireclay, potter's clay, kaolin, lime and paving and building stone are found in the southern parts of the state. The climate is equable and healthy. The mean height of the barometer is 30.010 inches. The prevailing winds are from the south and west in summer, veering round to the north in winter. The temperature has not as great a range as some of the neighboring states, averaging 20° in winter and 95° in summer. Indian corn, wheat, oats, barley, tobacco, and potatoes are the chief agricultural products. Molasses, cider, wine, honey, cheese, milk, are also plentifully produced. Immense herds of cattle and swine are reared. Woolens, cottons, lumber, agricultural implements, manufactures of iron, paper, and leather, are leading industries. The Ohio, White river, Wabash, and the Miami are the principal rivers. A canal 467 miles in length, from Evansville to Toledo, unites the Ohio, the Wabash, and Lake Erie.

So completely does the railway system cover the state that one can go from the capital to almost any county and return the same day. The geographical position of the state is such that all the main railroad through-lines between the east and west have to cross Indiana.

At the head of the institutions of higher education is the state university at Bloomington. Perdue university, at Lafayette, is the state agricultural college. There are a number of colleges, mainly under the control of religious societies, chief among which are Asbury university (Methodist) at Greencastle, Wabash college (Presbyterian) at Crawfordsville, Butler university (Christian) at Irvington (near Indianapolis), Notre Dame (Catholic) at South Bend, and Earlham college (Friends) at Richmond.

Indiana originally constituted a part of New France. It was visited by the Jesuits as early as 1672. At the beginning of the 18th century the French opened a line of communication between the lakes and the Mississippi by way of the Maumee, Wabash, and Ohio rivers. Trading posts for barter with the natives were established at the head of the Maumee, where is now the city of Fort Wayne; at Ouantenon, on the Wea Prairie, near the city of Lafayette; and at Vincennes on the Wabash. Missionary stations were also established by the Jesuit fathers, in their endeavor to convert the Indians. At the close of the French war in 1763–4, the territory east of the Mississippi and north of the Ohio passed under British dominion. Pending the war between Great Britain and the American colonies, Col. George Rogers Clark of Virginia, with an armed force, took possession of the territory, raising the American flag at Vincennes in 1778. By the treaty of 1783 between England and the United States this territory was recognized as belonging to the latter; inasmuch as Virginia had fitted out Clark's expedition, she was entitled by the law of conquest to claim this vast dominion. During the colonial war congress recommended the several states to cede their claims to unappropriated lands in the western country to the general government for the common benefit of the Union. Virginia, in pursuance of this request, yielded up her claims to the territory northwest of the Ohio. The deed of cession, executed on March 1, 1784, was signed by Thomas Jefferson, James Monroe, Arthur Lee, and Samuel Hardy. In 1787 congress

passed an ordinance for the government of the northwest territory, which provided, among other things, that not more than five states should ever be formed therefrom, prohibiting slavery, and declaring that "religion, morality, and knowledge being necessary to good government and the happiness of mankind, schools and the means of education shall forever be encouraged." This territory was subsequently divided into the states of Ohio, Indiana, Illinois, Michigan, and Wisconsin. The capital was moved from Vincennes to Corydon in 1813, and to Indianapolis in 1825. In 1811 Gen. William H. Harrison crushed the Indian tribes under Tecumseh at the battle of Tippecanoe. Indiana was admitted into the Union as a state by congress on April 19, 1816, being the sixth state received after the formation of the government by the thirteen original states and the adoption in 1787 of the present constitution. Its prosperity since the civil war has been largely due to the discovery of extensive coal, iron and gas fields and valuable deposits of building stone in different parts of the state, and to the construction of the Wabash and Erie canals.



State capitol, Indianapolis, Ind.

In national elections the state was democratic up to 1860 with the exception of the years 1836 and 1840, when it cast its vote for the whig candidate, William H. Harrison. It was republican from 1860 to 1872, democratic in 1876–1884 and 1892 and republican again in 1880-1888-1896-1900-1904 and 1908. The principal towns are Indianapolis (the capital), Evansville, Fort Wayne, Terre Haute, New Albany, Lafayette, South Bend, Madison, etc. Pop. 2,775,000.

INDIANAPOLIS, the largest city in and the capital of Indiana, the county seat of Marion county on the White river near the center of the state, mostly situated on a plain. It is 111 miles northwest of Cincinnati and 183 miles southeast of Chicago. It is the center of numerous railroads and is surrounded by rich agricultural and mineral regions. It is a place of great trade and its manufacturing interests are large. It is also an important market for grain, live stock, timber, etc., and carries on pork packing, the production of iron goods of various kinds, agricultural implements, woolens, flour, etc. The city is noted for the beauty of its streets which range from 40 to 120 feet wide. In the heart of the city is a circular plaza known as Monument place from which radiate four avenues to the four corners of the city. The most notable structure in the city is the soldiers and sailors monument. The notable buildings are the capitol 492 by 185 feet, built of Indiana limestone, manual training high school, the Claypole hotel, and the public library. The park system comprises 1250 acres and includes Riverside, Garfield, Brookside, Saint Clair and University parks. Educational and benevolent institutions are numerous, the former including the University of Indiana. Pop. 1909, 243,000.

INDIANA UNIVERSITY, a co-educational institution of learning, situated at Bloomington, Ind. The university is part of the state public school system and admits pupils from high schools without examination. It maintains a professional school of law, and confers the degrees of bachelor of arts, bachelor of laws, master of arts, and doctor of philosophy. The summer school, formerly privately conducted, is now a part of the university.

INDIAN CORN. See Maize.

INDIAN INK, a practically indelible writing ink of which there are two principal kinds—one prepared in Italy, Turkey, and Asia from certain cuttlefishes, the other in China by mixing fine lamp-black with glue or size and a little camphor. The former when submitted to the action of an alkali becomes brown sepia.

INDIAN MUTINY. See India (History).

INDIAN OCEAN, that great body of water which has Asia on the north, the Sunda isles and Australia on the east, Africa on the west, and the Antarctic ocean on the south. The Cape of Good Hope and the southern extremity of Tasmania may be considered its extreme southern limits on the west and east. Its length from north to south somewhat exceeds 6500 miles, its breadth varies from 6000 to 4000 miles. It is traversed by the equatorial current flowing east to west, and its navigation by sailing vessels is more or less modified by the periodic trade-winds and monsoons. Its greatest known depth is 3393 fathoms. Its chief arms are the Bay of Bengal on the east of India, and the Arabian sea on the west, extensions of the latter being the Persian gulf and Red sea. Madagascar, Ceylon, Mauritius etc., are among the islands.

INDIANS, American, the collective name given to the tribes inhabiting the continent at the time of the discovery by Columbus, and to such of their descendants as still survive. The name of Indians was first given to these races from the notion that the newly-discovered continent formed part of India The Esquimos or Innuit, the most northerly of the American tribes, are not usually classed among the Indians. Next below them are the allied Kenai and Athabascan groups, the former represented chiefly by the Yellow Knife or Atna tribe on the Yukon river. The Athabascans are chiefly found between Hudson's bay and the Rocky mountains, but includes besides the Chippeways, Coppermine, Dogrib, and Beaver Indians; the Tlatskanai, Unkwa, and Hoopah Indians of the Oregon coast; the Navaho tribe of the Highlands of New Mexico; the Apaches, ranging from the western Colorado to Chihuahua and Coahuila; and the Lipani, north of the mouth of the Rio Grande del Norte. Canada and the United States east of the Misissippi were formerly inhabited by the Algonquin-Lenappe and the Iroquois, generally at war with each other. The extreme west of the Algonquin region was occupied by the Blackfeet Indians; the Ojibeways held the shores of Lake Superior; south and west of Hudson's bay were the Crees. The Leni-Lenappe section of the Algonquin-Lenappe group comprised the five nations of the Delawares, including the Mohicans. The Iroquois included the Senecas, Cayugas, Onondagas, Oneidas, and Mohawks, who formed a league of five nations, afterward joined by the Tuscaroras. The Hurons were of the Iroquois group. The Dacotah or Sioux group occupied the plains between the Rocky mountains and the Mississippi as far south as Arkansas, and included the Assiniboins, Winnepegs, Iowas, Omahas, Osages, Kansas, Arkansas, Menitarees, Crows, and Mandans. West of the Mississippi also were the Pawnees and Riccaras about the Nebraska or Platte river, and to the southeast were the Choctaws and Chickasaws. In the Rocky mountain regions were the Shoshone or Snake Indians, including the Comanches and others. The Cherokee tribes, which inhabited South and North Carolina, formed a detached group, and the Texas Indians were comprised in many small and diverse tribes. Below these, in New Mexico, a more advanced and distinct family is found called Moquis or Pueblo Indians. Of the

numerous families occupying Mexico the Nahuatls or Aztecs were the most powerful and civilized. The Otomis, speaking a peculiar language, were also a numerous people in Mexico. In Central America the predominating family was the Maya, including the Quichés, Kachiquels, etc. Portions of the Aztec tribes were also found in Central America. In South America the leading and more advanced families were those that made up the Peruvian Empire, among which the Inca race and the Aymaras were the chief. The Araucanians, to the south of these, in Chili, had a considerable resemblance to the Algonquins and Iroquois of North America. The remaining portions of the continent, including the great alluvial tracts of the Atlantic slope, were principally occupied by the Guaranis; but along its northern coast were found the Caribs, who spread also over the Antilles and most of the West Indian Islands. In the extreme southern part of the continent live the tall Patagonians or Tehuelches, and squalid families in some respects resembling the more debasedAustralians.

By some ethnologists the American Indians are considered an aboriginal and single stock; by others a mixture of Mongolian, Polynesian, and Caucasian types; and by others as derived from the grafting of Old World races on a true American race. They are generally characterized as having long, black, and straight hair, scanty beard, heavy brows receding forehead, dull and sleepy eyes, a salient and dilated nose, full and compressed lips, and the face broad across the cheeks, which are prominent, but less angular than in the Mongolian. The facial angle is about 75° (about 5° less than the European average); the hands and feet are small and well proportioned. The complexion varies from dark-brown to almost white; a somewhat reddish tint is common. The North American Indian is described as of haughty demeanor, taciturn and stoical; cunning, brave, and often ferocious in war; his temperament poetic and imaginative, and his simple eloquence of great dignity and beauty. The Mexico-Peruvians worshiped the sun with human sacrifices and the grossest rites. Those of the United States and Canada believe in the two antagonistic principles of good and evil, and have a general belief in manitous, or spiritual beings, one of them being spoken of as the Gitche Manitou, or Great Spirit. They believe in the transmigration of the soul into other men and into animals, and in demons, witchcraft, and magic. They believe in life after death, where the spirit is surrounded with the pleasures of the "happy hunting grounds," though they have no idea that the acts of their present life can have any connection with their future happiness. They adopt a totem or symbol of the name of the progenitor of the family; this is generally some animal (the turtle, bear, and wolf being favorites), which is the mark of families even when expanded into tribes. No marriage rite is necessary beyond the consent of the parties and their parents; but the wife may be dismissed for trifling causes, and polygamy is allowed. In ancient times the body was covered with furs and skins according to the seasons, but now the white man's clothes and blanket have generally superseded the native dress; though the moccasin of deer or moose hide, and in the wilder tribes the ornamental leggings and headdresses, are largely retained. Their dwellings are made of bark, skins, and mattings of their own making, stretched on poles fixed in the ground. Their arms consist of the bow and arrow, the spear, tomahawk, and club, to which have been added the gun and knife of the whites. Canoes are made of logs hollowed out, or of birch bark stretched over a light frame, skilfully fastened with deers' sinews, and rendered watertight by pitch. The antiquities found in Mexico and Peru, and the ruins of elaborate buildings in Central America, prove that the semi-civilized races there existing had made considerable progress in sculpture and architecture.

INDIAN, AMERICAN, THE. The annual reports of the agents of the United States Bureau of Indian Affairs in 1905 show that the Indian population was 284,079, distributed in the several states as follows:

Arizona	38,725
California	15,519
Colorado	887
Florida	358
Idaho	3,560
Indian Ter	93,333
Iowa	342
Kansas	1,182
Michigan	6,333
Minnesota	9,164
Montana	10,324
Nebraska	3,639
Nevada	5,437
New Mexico	18,129
New York	5,290
North Carolina	1,455
North Dakota	7,741
Oklahoma	13,562
Oregon	5,913
South Dakota	19,601
Utah	1,953
Washington	9,798
Wisconsin	10,957
Wyoming	1,694
Miscellaneous	1,183
Total	284,079

Of the 274,706 Indian population in 1907, 116,333 wore citizens' dress and 43,602 wore a mixture of Indian and civilized clothing. Those who could read numbered 63,147 and 69,209 could carry on an ordinary converastion in English.

The total Indian population of the United States, exclusive of Alaska, numbered 284,079 in 1907. The expenditures of the United States on account of the Indians in the fiscal year ended June 30, 1906, were $14,236,078.71; in the fiscal year ended June 30, 1907, they were $12,746,859. The expenditures from 1789 to 1907, inclusive, have been $450,282,361.

The appropriation made by congress for Indian schools for the fiscal year ending June 30, 1907, was $9,405,199,98. The government supports 115 boarding schools, and 146 day schools. Indians incidentally under the Indian office and self-supporting:

The five civilized tribes, Indians and colored — Cherokees, 36,782; Chickasaws, 10,767; Choctaws, 25,116; Creeks, 15,923; Seminoles, 3,049. Total Indians, 71,018; total colored, 20,619; grand total	91,637
Pueblos of New Mexico	8,874
Six Nations, Saint Regis, and other Indians of New York	5,295
Eastern Cherokees of North Carolina	1,455
Indians under control of the War Department, prisoners of war (Apaches at Ft. Sill, Okla.)	298

INDIAN SUMMER, the name given to a period of mild summer weather which generally occurs toward the end of autumn in North America.

INDIAN TERRITORY, a tract of country allotted for the residence of certain of the Indian tribes who were partly removed from the southeast states of the Union. It is bounded mainly by Kansas, Texas, Oklahoma, and Arkansas, the southern boundary being formed by the Red river; area, 31,400 sq. miles. The chief rivers are the Arkansas and its tributaries (Canadian river Neosho, etc.) and the Red river and its tributaries. The greater portion is fertile and suited for stock-rearing. The Indian tribes or "nations" among which this territory has been apportioned are the Cherokees, Creeks, Seminoles, Choctaws, and Chickasaws, all of whom have made considerable advances in civilization, having schools, churches, newspapers, etc. The white inhabitants are increasing since the opening of coal-mines and the construction of railways. The territory possesses a coal-field of 20,000 sq. miles. Cultivation is now rapidly extending. The Indian Territory was formerly more than double its present size, but was reduced in 1889 and subsequently, by the loss of Oklahoma. The Indians of the territory, though not full citizens of the republic, are subject to the revenue laws and pay taxes. The Indian territory was part of the French possessions which the United States procured by the Louisiana purchase in 1803. The first Indians to settle here were the Creeks, Cherokees, Chickasaws, and Choctaws in 1834. The various tribes hold their reservations in common and govern themselves in accordance with their established customs, each nation having its own governor, legislature, judicial system, etc. With the great increase of the number of whites who have come into the territory, this plan of government has become inadequate, and gradually the tribal governments are being displaced by a general government. In 1893 a commission, known as the "Dawes Commission," to the five civilized tribes was appointed and has accomplished the following general results: The partial abolition of the Indian tribes and local governments (this is to be extended to total abolition), a survey of the lands; the enrollment of all Indians with a view to making an allotment of land to each one who is entitled to it; the establishment of a judicial system for the whole territory; the founding of a system of public schools, etc. In 1898 a bill "for the protection of the people of the Indian Territory," known as the Curtis bill was passed by congress. This act provides that the control of tribal funds is placed in the hands of the United States officers and also that white residents of the territory may incorporate towns within the Indian nations. As soon as the survey and enrollment are finished lands will be allotted and citizenship granted to each Indian in the territory and a general territorial government will be formed. On the 1st of January, 1898, the jurisdiction of the United States courts was established in the territory over the five civilized tribes. This had

the effect practically of abolishing the tribal court and in reality the substance of their individual governments.

Differences of conditions have prevented a uniform application of the policy. An agreement with the Seminoles permits the continuance of the Seminole government in a limited way and an agreement with the Choctaws and Chickasaws, until March 4, 1906. Pop. 450,000, With Oklahoma, Indian Territory was incorporated into the State of Oklahoma in 1907. See Oklahoma.

INDIA-RUBBER, a peculiar elastic substance composed of carbon and hydrogen, found in suspension in the milky juice of many different families of plants. The crude rubber is usually prepared where the juice is collected, by drying the juice over a fire or in the sun on moulds of clay, paddles, or lasts; by evaporating the juice in the sun and removing the successive pellicles formed on the surface; or by coagulating the juice, as in Nicaragua, by an application of the juice of the bejuca vine, and kneading and rolling the coagulated mass. Most of the rubber of commerce is derived from South America, from Para, Central America, Mexico, Carthagena, etc.; smaller quantities from Java, Penang, Singapore, Assam, and South Africa. The purest comes from Para in large bottles and thick plates. When combined with a small quantity of sulphur, etc., it is used for the manufacture of overshoes, boots, gloves, life-preservers, gas-bags, steam and water packing, belting, fire-hose, tubing, springs, tires, artificial sponges, etc. With a larger proportion of sulphur, and cured or vulcanized by exposure to a high temperature, it is used for the manufacture of combs, pen and pencil holders, rulers, inkstands, buttons, canes, syringes, jewelry, and, when colored with vermilion, for mountings for artificial teeth, etc. In combination with asphalts, oils, and sulphur, etc., and vulcanized (keritc) it is used for covering telegraph wires.

INDIC'ATIVE, that mood of the verb in which something is said positively; hence it has also been called the positive mood, as distinguished from the subjunctive and potential.

IN'DICATOR, (1) an instrument for ascertaining and recording the pressure of steam in the cylinder of a steam-engine, in contradistinction to the steam-gauge, which shows the pressure of the steam in the boiler. (2) An apparatus or appliance in a telegraph for giving signals or on which messages are recorded, as the dial and index hand of the alphabetic telegraph. (3) A genus of African birds, the honey-guides or honey-guide cuckoos.

INDICTMENT (in-dīt'ment), in law, a written accusation of one or more persons for a crime or misdemeanor, preferred to and presented upon oath by a grand-jury to a court.

INDIGESTION. See Dyspepsia.

IN'DIGO, a blue vegetable dye, extensively employed in dyeing and calico-printing; an important commercial product in the East and West Indies, Mexico, Brazil, Egpyt, etc. It is chiefly obtained from various leguminous plants, herbaceous or shrubby plants, with pinnate leaves, and small, blue, purple, or white pea-shaped flowers disposed in axillary racemes. They are very numerous in the equatorial regions of the globe. The greater part of the indigo used at the present day comes from India, especially from the provinces of

Indigo-plant.

Bengal, Oude and Madras. The color varies from light-blue to blackish-blue; when rubbed with the nail a copper-colored streak is formed on the surface of the mass. Indigo is insoluble in water, but when exposed to the action of certain deoxidizing agents it becomes soluble in alkaline solutions, losing its blue color and forming a green solution from which it is precipitated by acids white, but it instantly becomes blue on exposure to the air. Commercial indigo contains about 50 to 60 per cent of pure indigo blue, the remainder consisting of substances called indigo gluten, indigo yellow, indigo red, etc.

IN'DIUM, a metal discovered by Reich and Richter in 1863 by means of spectroscopic analysis in the zinc-blende of Freiburg. It has been isolated in small quantities, and is of a silver-white color, soft, and marks paper like lead; specific gravity, 7.421 at 16°.8. The metal is related to cadmium and zinc, and its spectrum exhibits two characteristic lines, one violet and another blue.

INDO-CHINA, a name sometimes given to the southeastern peninsula of Asia, comprising Burmah, Siam, Cambodia, Cochin-China, Tonquin, Anam, etc.

INDO-EUROPEAN LANGUAGES, also called Aryan or Indo-Germanic, the most important of the great families into which human speech has been divided, spoken by various peoples in Asia and Europe. The chief branches of this family are the Teutonic or Germanic, including English, German, Dutch, Danish, Swedish, Icelandic, and the extinct Gothic; the Slavonic (Polish, Russian, Bohemian); the Lithuanian; the Celtic (Welsh, Irish, Gaelic, Breton); the Latin or Italic, and the Romance tongues descended from it (French, Italian, Spanish, Portuguese); the Greek, the Armenian, the Persian, and the Sanskrit. All these tongues are regarded as being descended from a common ancestral tongue or parent speech, spoken at some remote period in Central Asia, whence the ancestors of the modern peoples speaking these tongues spread into India, Western Asia, and Europe. See Philology.

INDORE, or **INDOR,** a protected native state of Hindustan, connected with Central India, and consisting of several detached portions, the largest being bisected by the Narbada; total area, 8400 sq. miles. Pop. 86,686.

INDORSEMENT, or **ENDORSEMENT,** See Bill.

INDRA, a Hindu deity, originally representing the sky or heavens, and worshiped in the Verdic period as the supreme god, though he afterward assumed a subordinate place in the Pantheon. He is commonly represented

Indra—Coleman's Hindu mythology.

with four arms and hands riding on an elephant. When painted he is covered with eyes. He is at once beneficent as giving rain and shade, and awful and powerful in the storm as wielding the thunderbolt. In one aspect he is lord of Swarga, the beautiful paradise where the inferior gods and pious men dwell in full and uninterrupted sensuous felicity.

INDRE (andr), a department of Central France; area, 2622 sq. miles. Châteauroux is the capital. Pop. 288,788.

INDRE-ET-LOIRE (andr-é-lwär), a department of Central France; area, 2362 sq. miles. Tours is the capital. Pop. 335,541.

INDUCED CURRENT, the current of electricity which is produced or excited in a conductor when the magnetic field in which it is placed is altered in any way; that is, 1st, when the strength of the current in a neighboring conductor is altered; or 2d, when a neighboring conductor in which a current flows is altered in position; or 3d, when a neighboring magnet is moved; or 4th, when the magnetization of a neighboring magnet is altered. Thus if there is a closed circuit, say a coil of wire with its ends joined, through which no current is passing, the motion of a magnet in its neighborhood will induce a current in it, the direction of this current being always such as to oppose the motion.

INDUCTION, in logic, is that process of reasoning by which we rise from the particular to the general, and is the counter-process to deduction. In induction particulars are not only raised into generals, but these into still higher generalities. In following this method we proceed from the known to the unknown, and obtain a conclusion much wider than the premises. Thus a person who has had any experience easily arrives by induction at the conclusion that fire burns wood, and when any piece of wood whatever is presented to him he will have no hesitation in saying that fire will burn it. As it is impossible that all particulars can be observed, there is always a certain risk of error, and the inductive method must be worked with extreme caution; but science properly so called would be impossible if we did not presuppose a faculty of arriving from experience at the knowledge of truths not contained in that experience. Hence the ground

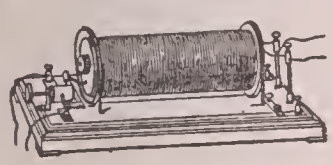
of induction is the established fact that nature is uniform.

INDUCTION, Electromagnetic, the action by which a current of electricity is produced in a conductor when the magnetic field in which it is placed is altered inany way. See Induced Current.

INDUCTION, Electrostatic, the action by which the distribution of a charge of electricity on a conductor is altered by the approach of an electrified body. When a body charged with one kind of electricity is approached toward an insulated conductor which originally had no charge, a charge similar to that of the influencing body is produced on the remote side, and an equal charge of the opposite kind on the near side of the insulated conductor. It is to the mutual induction between the two coatings, one charged positively and the other negatively, that the Leyden-jar is indebted for its large electrical capacity.

INDUCTION, Magnetic, the action by which iron and other substances become magnetic when in a magnetic field, that is, when in the neighborhood of magnets or currents of electricity. See Electromagnetism, Magnetism.

INDUCTION-COIL, an instrument invented by Ruhmkorff, in which rapid breaking and making of the current of electricity in a primary short coil of wire gives rise to a succession of induced cur-



Induction-coil.

rents (see Induced Current) of very great electromotive force in a long secondary coil. In the figure the secondary coil is the one shown wound up in a cylindrical form. Such a coil often consists of a copper wire many miles in length, and a succession of powerful sparks passes between its terminals when the primary current is rapidly made and broken.

INDULGENCE, in the Roman Catholic system, is the remission granted by the church to a repentant sinner of the temporal punishment due to his sin, whether this punishment be the pains of purgatory, or penance which the church has the right to impose according to the gravity of the sin. It must be understood that the indulgence is never to be considered as constituting a remission of the sin itself. The principle of indulgences rests on that of good works. Many saints and pious men have done more good works and suffered more than was required for the remission of their sins; these are known as works of supererogation, and the sum of this surplus constitutes a treasure for the church, of which the pope has the keys, and is authorized to distribute as much or little as he pleases in exchange for pious works or gifts. Indulgences are of two kinds: plenary, when considered an equivalent substitute for all penance; and partial, when only a portion of penitential works is relaxed. Local indulgences are attached to particular places, real indulgences to crucifixes, medals, etc. The historical origin of indulgences is traced to the public penances and the canonical punishments which the early Christian church imposed on offenders, especially on those who were guilty of any grievous crime, such as apostasy, murder, and adultery. When ecclesiastical discipline became milder it was allowed to commute these punishments into fines for the benefit of the church. The abuse of the system of granting indulgences inflamed the zeal of Luther, and the Protestant theologians have always found indulgences one of the most vulnerable points of the Roman Catholic system.

INDUS, the chief river of the northwest of Hindustan, It has a length of about 1800 miles, drains an area of about 370,000 sq. miles, and rises in Tibet on the north of the Himalaya mountains.

INDUSTRIAL EXHIBITION. See Exhibition.

INDUSTRIAL SCHOOLS, a class of schools, of a philanthropic, reformatory, or experimental nature, in which industrial work is taught to boys and girls. The primary purpose of the industrial instruction varies from the mere desire to keep boys off the streets to the serious effort to teach a trade. Broom and brush making, chair-seating, or basketry, are prominent in such schools.

INEBRI'ETY, habitual or chronic drunkenness. See Drunkenness, Delirium Tremens, Intoxication, Dipsomania.

INERTIA, the passiveness of matter, or its indifference to rest or motion. Newton's first law treats of this property in virtue of which a body at rest will remain at rest, and a body in motion will continue to move in a straight line and with a uniform velocity unless some force acts upon it.

INFALLIBILITY, exemption from the possibility of error in regard to matters of religion and morals—a claim made by the Roman Catholic Church both on its own behalf and on that of the pope when speaking ex cathedra, or in his official capacity. The infallibility of the church is of two kinds, active, and passive; the former signifying the function of the church of permanently teaching the truths of God, and of authoritatively settling doctrinal disputes; and the latter that property inherent in the church in virtue of which she can never receive or embrace erroneous doctrine. The infallibility of the pope, long taught, was only settled as an article of faith in the Vatican Council of 1870.

INFANT, a term in the English and American law for persons who have not attained their majority, that is, the age of twenty-one years, and are under guardianship. In general, contracts made by infants are not binding, except for necessaries suited to their station in life. Being an infant is no bar to criminal proceedings; but young persons are not punished for offenses if they have not knowledge and discretion to distinguish them to be such. Infants require the consent of parents or guardians to marry. The jurisdiction in respect to infants is generally vested in either probate or orphans' courts. These courts appoint guardians to take charge of the property of infants, and, in case of the decease of the father, to take charge of their persons; but during the life of the father he has the guardianship and control of the persons of his children until they are twenty-one years of age.

INFANTE (in-fân-tā) or infant, the title given in Spain and Portugal to the princes of the royal house. The princesses are called infanta.

INFAN'TICIDE, the murder of an infant, a crime that is especially common in the case of illegitimate children, the main cause being shame; but infanticide is sometimes the result of puerperal insanity. In trial for infanticide it must be proved that the child was fully born alive. Infanticide was prevalent in Greece and Rome. In modern times many barbarous nations are guilty of wholesale child-murder. Among the South Sea Islanders and aboriginal Australians the destruction of infant life is systematized. The Hindus destroy female children without compunction, and abortion is common among the Mohammedans. In China, also, infanticide is supposed to be frightfully common.

IN'FANTRY, foot-soldiers collectively. Except among semi-barbarous nations, and during the prevalence of the institutions of chivalry, infantry has always been considered the most important military arm, and this has been peculiarly the case since the formation of standing armies, and since war has become a science. Infantry may be divided into various classes, and most commonly into light infantry and infantry of the line, to which should also be added mounted infantry, a force which from its mobility has proved itself of immense value in special circumstances. Under equal conditions well-trained infantry is almost universally successful against any other kind of troops.

INFANT SCHOOLS, schools, the object of which is to amuse, interest, and instruct children from their third to their sixth year. Jean Frédéric Oberlin, Protestant pastor of Waldbach, in Alsace, is regarded as their founder. In 1812 Robert Owen established one at New Lanark, in Scotland, the first attempt of the kind in Great Britain. A second was set on foot in Westminster in 1819, of which Samuel Wilderspin (1792–1866) was one of the first teachers. In England infant schools are more popular, and proportionally more numerous, than in Scotland. In Germany there are numerous Kleinkinderschulen, or Kindergärten; in France, under the name of "Asylums," they are wide-spread; and the kindergärten system (founded about 1840) is acquiring high credit both in Great Britain and in the United States. In dealing with infants of tender years a frequent mistake of teachers is to attempt too much. Physical more than intellectual development should be aimed at; the moral faculties should be trained by an enlightened, judicious, and sympathetic teacher. The school should be a playground, and elementary instruction should be simple, pleasing, and as much as possible imparted by means of models, pictures, and simultaneous singing.

INFECTION, a term sometimes used to signify the communication of disease through the atmosphere, as contrasted with contagion (con, and tango, to touch), communication of disease through

the medium of touch. In many cases Infection and Contagion are used as synonimous.

INFECTIOUS DISEASES. See Contagion.

INFERIOR PLANET, a planet whose orbit lies within that of the earth. Mercury and Venus are the inferior planets.

INFINITES'IMAL, in mathematics, an infinitely small quantity, or one which is so small as to be incomparable with any finite quantity whatever, or which is less than any assignable quantity. The infinitesimal calculus is a department of the higher mathematics which embraces both the differential and the integral calculus.

INFIN'ITIVE, the indefinite mood of a verb, or that in which the verb is represented without a subject; the mere name form of the verb. As the verb expresses an action, or a state, it generally belongs to a subject whose action or state is expressed; but if we wish to express the mere idea of this action or state we use the infinitive, which, therefore, in many languages is employed without further change as a substantive—for instance, the Greek and German—only preceded by the neuter article. The infinitive may be regarded as the point of transition from a verb to a substantive, and is often used as the subject of a proposition.

INFIRMARY. See Hospital.

INFLAMMA'TION, a vague term for a morbid process, of which the most obvious phenomena are pain, swelling of the affected part, perceptible increase of heat to the patient, and redness beyond the natural degree, often followed by febrile symptoms. Inflammations may arise from external injuries, or may be brought on by morbid or poisonous matters in the system, sudden changes of temperature, etc. The three commonly described terminations of inflammation are resolution, suppuration, and mortification or sloughing. Resolution is that recovery from the disorder which is effected without the intervention of any disorganizing process and when the vessels return to their normal condition on the exciting cause of the disorder being withdrawn, and this is the most favorable mode of termination. If inflammation cannot be resolved it must go on to suppuration, when the skin is either divided by the knife or breaks of itself, and there is an escape of a yellow cream-like fluid, after which the symptoms rapidly abate. The tendency to suppuration is marked by the pain becoming full and throbbing, while the pulse becomes more full without being less frequent. Mortification is accompanied by the sudden cessation of pain, and there is the actual death of the part affected. When the circumstances are favorable this dead part sloughs off by a vital process known as ulcerations, and the cavity gradually fills up and heals. In many cases inflammation may rather be considered as a salutary process than as a disease, for it frequently prevents evils which would occasion either serious or fatal consequences. The most important remedy in cases of severe inflammation is hot fomentations, blisters, bloodletting, the warm bath, combined with low diet and perfect quietude. As to inflammation of the intestines, see Enteritis; of the eye, see Iritis; of the bowels see Peritonitis; of the brain, see Meningitis; of the lungs, see Pneumonia.

INFLORES'CENCE, in botany, the mode of flowering of any species of plant, that is, the manner in which its blossoms

Varieties of inflorescence.

1, Spike. 2, Amentum or catkin. 3, Raceme. 4, Panicle. 5, Whorl. 6, Umbel—*a*, simple, *b*, compound. 7, Cyme. 8, Corymb. 9, Thyrsus. 10, Head or capitulum. 11, Fasciculus or fascicle. 12, Spadix. 13, Anthodium.

are grouped together, and in some cases in which they successively open. The principal forms of inflorescence are the amentum, corymb, eyme, head or capitulum, fascicle, raceme, panicle, thyrsus, spike, whorl (see those terms); centrifugal and centripetal are also terms applied to two kinds of inflorescence.

INFLUEN'ZA (Italian influence), a term used to denote an epidemic catarrh of a rather severe character, the symptoms of which are those of what is usually called a cold, with others such as lassitude and general depression, loss of sleep, feverishness, nausea, loss of appetite, sometimes vomiting, often an inflammatory state of the throat and pharynx, bronchitis, or other complications. It is not usually fatal, the patient generally recovering in a week or ten days, but it sometimes leaves behind chronic bronchitis or consumption. It has at various times spread more rapidly and extensively than any other disorder.

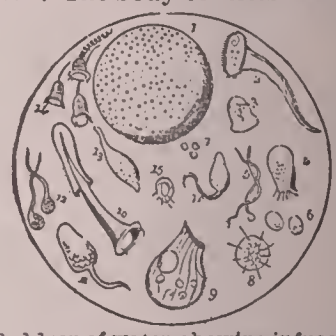
INFRINGEMENT, any violation of a law or invasion of a legal right which gives rise to a cause of action, in law or equity, in favor of the person injured thereby. The term is commonly employed in a technical sense to describe an unlawful appropriation of ideas, principles, or rights when protected by copyrights, patents or trademarks. The remedy for an invasion of these statutory rights is an action at law for the damages sustained; or a court of equity will, upon application, enjoin the infringement, thus securing an absolute enjoyment or monopoly of the principles or ideas embraced in the work or device so protected.

The manufacture, use, or sale of a thing, the subject matter of which is the principle or novelty of a patented invention, constitutes an infringement of the latter. To prove that an alleged new device incorporates the substance of an invention so protected, it is necessary to establish that the same result is accomplished, the same functions performed, and that the mode of operation is substantially the same. If these characteristics are present a mere change in the form or in the location of the parts of a patented article will not save the device thus constructed from being an infringement of the patentee's rights.

The unlawful use of a mark or device which another has registered to provide a means of identification of his goods for the general public is an infringement of a trademark. Any device which is so similar to a registered trademark as to deceive or mislead the public constitutes an infringement thereof, even though it would not be difficult to distinguish the two when placed together. The remedy for such infringement is by injunction.

INFUSION, a solution of some vegetable substance in hot or cold water, such as are often used for medicinal purposes. The water employed may be at boiling heat, but if the substance is itself boiled the result is a decoction. In preparing certain infusions cold water is preferable, a sbringing out the constituent desired. The process of making an infusion is much the same as that of making tea.

INFUSORIA, a class of minute, mostly microscopic, animals, so named from being frequently developed in organic infusions, provisionally regarded as the highest class of the Protozoa. They are provided with a mouth, are destitute of pseudopodia, but are furnished with vibratile cilia. Most are free-swimming but some form colonies by budding, and are fixed to a solid object in their adult condition. The body consists of an outer



Magnified drop of water, showing infusoria, etc.

1, Volvox globator (a plant, a low form of Algæ). 2, Stentor polymorphus. 3, Urceolaris scyphina. 4, Stylonychia mytilus. 5, Zoospermos ferussaci. 6, Trichoda carinum. 7, Monas termo. 8, Pandorina morum. 9, Bursaria truncatella. 10, Vaginicola crystallina. 11, Cercaria gibba. 12, Zoospermos decumanus. 13, Amphileptus fasciola. 14, Vorticella convallaria. 15, Euptotes truncatus. 16, Trachelocerca olor.

transparent cuticle, a layer of firm sarcode called the cortical layer, and a central mass of semiliquid sarcode which acts as a stomach. A nucleus, which is supposed to be an ovary, having attached to its outside a spherical particle called the nucleolus, and supposed to be a spermatic gland, is imbedded in the cortical layer. Contractions of the body are effected by sarcode fibers. The cilia, with which most are furnished, are not only organs of locomotion, but form currents by which food is carried into the mouth. Reproduction takes place variously. They are divided into three orders, Ciliata, Suctoria, and Flagellata, in accordance with the character of their

cilia or contractile filaments. Many of the organisms included by the older zoologists among infusoria are now generally regarded as vegetable.

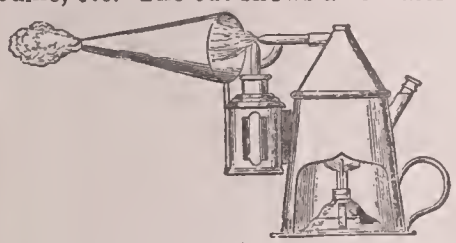
INGALLS, (in'galz), John James, American politician, born at Middletown, Conn., in 1833. In 1858 he removed to Atchison, Kansas, and began the practice of law. After the admission of Kansas to the Union in 1861 he became secretary of the new state senate, and in 1862 was a member of the senate. In 1873 he was elected to the United States senate, and was re-elected in 1879 and 1885. He died in 1900.

INGELOW, (in'je-lō), Jean, English poetess, was born in 1820. In 1863 she published a volume of poems, which ran through fourteen editions in five years, and her popularity has since increased both through her prose writings and her poetry. In prose she has written novels and tales for children, including Mopsa the Fairy, Studies for Stories, Off the Skelligs, Sarah de Berenger, Don John, etc. She died in 1897.

INGERSOLL, Robert Green, American lawyer and lecturer, was born at Dresden, N. Y., in 1833. He removed with his family to Illinois in 1845. In 1862 he went to the war as colonel of the Eleventh Illinois cavalry. In 1868 he was appointed attorney-general of Illinois. In 1876 a speech in favor of the candidacy of James G. Blaine at the republican presidential convention won for him a national reputation and from this time he was recognized as one of the foremost orators of the day. He soon after entered the lecture field, adopting religious topics as his subjects, attacked the Bible, the personal nature of the deity and the existence of hell. He died in 1899.

INGOT (ing'got), a small bar of metal made of a certain form and size by casting it in moulds. The term is chiefly applied to the small masses or bars of gold and silver intended either for coining or exportation to foreign countries.

INHALER, an apparatus for inhaling vapors, and volatile substances, as steam of hot water, vapor of chloroform, iodine, etc. The cut shows an inhaler of



Inhaler.

improved type. It consists of a tin can containing a small spirit-lamp, and above this a small kettle for hot water, the steam of which is driven out with some force when the apparatus is used. Attached to the can is a receptacle for receiving a small phial containing the substance whose vapor is to be inhaled, this being drawn off and forced through the funnel by the steam.

INHERITANCE. See Descent.

INHERITANCE TAX LAWS, a law taxing the right to inherit personal property by will or interstate law was passed by congress July 6, 1797. The rate was 25 cents on amounts from $50 to $100, 50 cents on amounts from $100 to $500, "and for every further sum of $500, the additional sum of one dollar." This act continued in force until June 30, 1802, when it was repealed. A national legacy tax law was again enacted July 1, 1862, amended in 1864, and again in 1866, and repealed in 1870, five years after the close of the civil war.

Again, June 13, 1898, congress enacted a legacy tax law which was amended in 1901 and continued in force until repealed July 1, 1902. Under the acts of 1898 and 1901, the sum of $21,603,699.02 was collected and paid into the national treasury up to June 30, 1904.

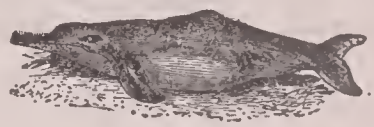
Pennsylvania enacted a legacy tax law April 6, 1826, which law as amended from time to time, is still in force. Legacy tax laws were enacted in Maryland in 1844, and Delaware in 1869. They were enacted in North Carolina in 1846, and repealed in 1883. They were enacted in Virginia in 1844, repealed in 1855, re-enacted in 1863, and again repealed in 1874. Since 1885 legacy tax laws have been enacted in twenty-nine different states, namely: Arkansas, California, Colorado, Connecticut, Illinois, Iowa, Louisiana, Kentucky (1906), Maine, Massachusetts, Michigan, Minnesota, Missouri, Montana, Nebraska, New Hampshire (1905), New Jersey, New York, North Dakota, Ohio (repealed 1906). Oregon, Tennessee, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin and Wyoming.

The following table shows the amount of legacy tax collected from the estates of some of the prominent and wealthy decedents, some of whom were of national reputation:

*George Smith, resident of England (paid in New York)	$1,934,753.07
Collis P. Huntington, New York	665,000.00
Jay Gould, New York	600,000.00
Cornelius Vanderbilt, New York	450,052.90
Cornelia M. Stewart, New York	300,410.32
Winfield S. Stratton, Denver, Colo.	300,000.00
Wilson G. Hunt, New York	285,000.00
Joshua Jones, New York	284,937.56
Emma A. Schley, New York	261,490.67
Henrietta A. Lenox, New York	234,635.70
William Whitewright, New York.	233,141.52
Robert G. Dun, New York	178,730.68
Catherine L. Wolfe, New York	159,599.38
Daniel B. Fayerweather, New York	158,296.19
George M. Pullman, Illinois	158,282.04
John Knower, New York	152,319.72
Daniel Edgar Crouse, Syracuse, New York	150,882.48
Timothy B. Blackstone, New York and Illinois	150,661.01
Henry B. Plant, New York	140,000.00
Ezra G. Benedict, Albany, N. Y.	131,122.99
Mary J. Walker, New York	119,223.83
Joseph C. Hoagland, New York	119,211.80
Gustav W. Swift, Illinois	113,885.27
Jonathan Scoville, New York.	112,758.08
Mary J. Winthrop, New York	110,169.55
Leonard Lewisohn, New York	107,634,36
William Astor, New York	106,536.97
William H. Vanderbilt, New York.	103,612.59
Mary Eichler, New York	102,866.94
W. W. Kimball, Illinois	86,700.24
A. M. Billings, Illinois	85,724.75
Potter Palmer, New York and Illinois	78,063.99
Ernest J. Lehman, Illinois	71,097.16
Silas B. Cobb, Illinois	63,298.32
Levi Z. Leiter, Illinois	48,295.83
Sidney Kent, Illinois	38,070.09
Peter Fahrney, Illinois	37,982.88
Jacob Rosenberg, Illinois	37,667.32
Charles W. Fullerton, Illinois	36,461.02
Catherine M. White, Illinois	25,236.38
Columbus R. Cummings, Illinois	21,864.40
Joseph Medill, Illinois	16,048.46
Phillip D. Armour, Illinois	15,786.91
Lucius B. Otis, Illinois	15,699.41

*The transfer of all property, real, personal, or mixed, within the jurisdiction of the state at date of death is subject to the tax, whether the decedent was a resident or non-resident. The tax is not a tax on property, but the right which the state grants to the legatee to inherit property.

INIA, a genus of Cetacea belonging to the dolphin family, containing only one known species, remarkable for the distance at which it is found from the sea,



Inia boliviensis.

frequenting the remote tributaries of the river Amazon, and even some of the elevated lakes of Peru. It has bristly hairs on its snout, and is from 7 to 12 or 14 feet long.

INJECTIONS, in surgery, fluids, different, according to the different effects desired to be produced, thrown by means of a small syringe into the natural cavities of the body, or those occasioned by disease. Wounds and sores are usually cleansed in this way when they extend far below the skin. In diseases of the nose, the ears, the bladder, and urethra, the uterus, etc., injections are often used. Pure warm water is injected with the highest success for the removal of pus, blood, or even foreign bodies. Sometimes astringent medicines, to restrain excessive evacuations, sometimes stimulating ones, sometimes soothing medicaments, to mitigate pain, etc., are added to the water.

INJECTOR, an apparatus for supplying the boilers of steam-engines, especially locomotive-engines, with water. It works equally well whether the engine is running or at rest.

INJUNCTION, in law, a prohibitory writ, restraining a person from doing some act which appears to be against equity, and the commission of which is not punishable by criminal law. It is either provisional, until the coming in of the defendant's answer, or perpetual, that is, perpetually restraining the defendant from the commission of an act contrary to equity. Disobedience to an injunction constitutes contempt of court, and is punishable accordingly.

INK, a liquid or pigment used for writing or printing. All ordinary writing inks owe their properties to the presence of gallate or tannate of iron held in suspension by means of gum. Gall-nuts contain gallotannic acid, which gives a black precipitate with persalts of iron; they also contain pectose, which converts gallotannic acid, when exposed to the air, into gallic acid. This latter acid colors ferric salts a much deeper black than the former acid. The essential points in the preparation of a good writing ink are therefore the presence of an iron salt, an infusion of gall-nuts and gum, and the allowing the mixture to remain for some time exposed to the air. All other substances which are added to ordinary ink as coloring matters in the place of gall-nuts only impair its quality. As ink is liable to become moldy it is customary to add a small quantity of such substances as essential oils, carbolic

acid, crushed cloves, or sometimes corrosive sublimate, in order to prevent this result. For copying ink a little sugar is added, which prevents its drying rapidly and perfectly. Colored writing-inks, as red, blue, etc., are simply solutions of some coloring materials, cochineal and Brazil-wood being used for red, Prussian blue for blue, etc. Gold and silver inks consist of a fine powder of the metals suspended in a solution of gum-arabic.—Marking ink usually consists of a solution of silver nitrate thickened with gum and sometimes colored by means of sap-green.—Printing-ink may be made by boiling linseed-oil and burning it about a minute, and mixing it with lamp black, with an addition of soap and resin. If it be wished to obtain colored printing inks, this may be done by adding the necessary pigments to the oil while it is being heated. Vermilion is used to give a red color, ultra-marine for blues, and lead chromate for yellows.—Lithographic ink used in printing from the stone, is usually composed of virgin wax, dry white soap, tallow or lard, shellac, mastic, and lamp or Paris black.—Sympathetic inks have been sometimes used in secret correspondence. They are of various kinds. For instance, characters written in solutions of cobalt, lemon juice, and dilute sulphuric acid make no appearance on the paper, but become visible when treated with some other solution or exposed to the action of heat. See also Indian Ink.

INLAND REVENUE, that department of the revenue which includes the branches of excise, taxes, and stamps.

INLAYING is the art of ornamenting flat surfaces of one substance by inserting into cavities cut in them pieces of some other substance. Various kinds of metal or wood, or pearl, ivory, etc., are employed in this process.

INN, a house where travelers are furnished for the profit of the provider, with everything they have occasion for while on their journey. They may be set up without license by any person, provided he refrains from selling excisable liquors, which of course require a license. Public-houses, taverns, victualling-houses, and coffee-houses are all inns when the keepers of them make it their business to furnish travelers with food and lodging; otherwise they are not. Innkeepers are bound to take in all travelers and wayfaring persons, and to entertain them if they have accommodations for them (and they are only bound to give such accommodation as they have), at reasonable charges, provided they behave themselves properly.

INNATE IDEAS, certain primary notions or impressions, supposed by some philosophers to be given to the mind of man when it first receives its being, and to be brought into the world with it. Descartes distinguished ideas into innate, adventitious, and factitious. An innate idea he described as not one that presents itself always to our thought, for there could be no such idea; but one that we have within ourselves the faculty of producing. He did not enumerate such ideas, however. What the followers of Descartes designate innate ideas, those of Cousin term universal, necessary, and absolute.

INNESS (ĭn ĕs), George, American landscape painter, was born at Newburgh, N. Y., in 1825. Innes is considered the greatest of American landscape painters. His subjects included sunrise, high noon, sunset, and evening. A notable exhibition of his paintings numbering two hundred and forty was held in New York in 1894. Among his most important works are: Under the Greenwood, Close of a Stormy Day, An Autumn Morning, Moonrise, Winter Morning. He died in 1894.

INNOCENT, the name of thirteen popes, of whom only the following need be particularly dealt with:—Innocent I. succeeded Anastasius I. as Bishop of Rome in 402. He supported St. Chrysostom, and renounced the communion with the Eastern churches on account of their treatment of that eminent man. In 409 he was sent to obtain terms of peace from Alaric, but without success. He died in 417, and is one of the most distinguished saints, his day being July 28.—Innocent II., a Roman of noble birth, elected pope in 1130 by a part of the cardinals, while the others elected Peter of Leon, who took the name of Anacletus. Innocent fled to France, where he was acknowledged by Louis VI. and by Henry II. of England; also by the Emperor Lothaire, who conducted him in 1133 to Rome, where Anacletus also maintained his claims as pope. Innocent was obliged to retire, and though reinstated in 1137 Anacletus maintained himself until his death in 1138. Innocent in 1139 held the second Œcumenical Council in the Lateran, which condemned the opinions of Arnold of Brescia, and declared the decrees of Anacletus null. Innocent died in 1143.—Innocent III., Lothario, Count of Segni, born in 1161, was unanimously elected pope at the age of thirty-seven. He displayed great energy, and much enhanced the papal power. He excommunicated Philip Augustus, king of France, and laid his kingdom under an interdict in 1200 because Philip had repudiated his wife, and obliged the king to submit. He extorted a similar submission from John, king of England, who refused to confirm the election of Langton as Archbishop of Canterbury, by laying the kingdom under an interdict, and in 1212 formally deposing him. Almost all christendom was now subject to the pope, two crusades were undertaken at his order, and his influence extended even to Constantinople. The cruel persecution of the Albigenses and the establishment in 1198 of the inquisitorial tribunals, from which the inquisition itself originated, were noteworthy events of his pontificate. In 1215 he held a council by which transubstantiation and auricular confession were established as dogmas, and the Franciscan and Dominican orders were confirmed. Innocent died in 1216. He left various works on legal and theological subjects; and the Stabat Mater, Veni Sancte Spiritus, and other sacred hymns, are said to have been written by him.—Innocent XI., Benedetto Odescalchi, born in 1611, served in his youth as a soldier, took orders at a later period, and rose through many important posts, until he was elected pope in 1676, on the death of Clement X. He was eminent for probity and austerity. Though hostile to the Jesuits, whose opinions he attacked in the decree Super quibusdam axiomatis moralibus, yet he was obliged to condemn Molinus and the Quietists. Being involved in a dispute with Louis XIV., the authority of the pope in France and elsewhere received a severe blow in the IV. Propositiones Cleri Gallicani (Four propositions of the Gallican clergy, 1682). These disputes were highly favorable to the English revolution, as it induced the pope in 1689 to unite with the allies against James II., in order to lower the influence of Louis XIV. He died in 1689, and was succeeded by Alexander VIII.

INNS OF COURT, four very ancient societies in London exclusively invested with the right to call to the English bar; also the buildings belonging to these societies, in which the members dine and barristers have chambers. The gentlemen belonging to these societies may be divided into benchers, outer barristers, inner barristers, and students. The benchers are the highest in rank, being usually queen's counsel; and it is they who have the right of granting or refusing a call to the bar, or of disbarring persons unfit to practice. The four inns of court are the Inner temple and Middle temple (formerly the dwelling of the knights templars, and purchased by some professors of law more than three centuries since); Lincoln's inn and Gray's inn (anciently belonging to the earls of Lincoln and Gray).

INOCULATION, in medicine, the introduction, by a surgical operation, of a minute portion of infective matter into contact with the true skin, for the purpose of exciting artificially a milder form of some contagious disease, and thereby protecting the human system against similar attacks in future; keeping in mind, however, that such a process can be only of efficacy in regard to diseases which attack us only once in the course of our lives, such, for instance, as small-pox. The term is chiefly used in connection with small-pox. The practice of inoculation with the matter of small-pox, although long followed in some parts of Wales, seems to have been scarcely known throughout England till the early 18th century, and its adoption was chiefly due to the exertions of Lady Mary Wortley Montagu, who became acquainted with it in Turkey. For many years the practice met with the greatest opposition, both from the medical profession and the clergy; but latterly it came extensively into vogue, the small-pox thus induced being of a milder and much less often fatal type than ordinary small-pox. The great objection to it was that it tended to spread this serious disease, inoculated small-pox being equally infectious with the other kind. After the discovery of vaccination by Jenner in 1798 inoculation was gradually superseded, and the British legislature even prohibited the latter, while vaccination is compulsory. See Small-pox and Vaccination.

INQUEST. See Coroner.

INQUISITION, in the Roman Catholic Church, a court or tribunal established for the examination and punishment of heretics. The institution was founded in the 12th century by Father Dominic, who was charged by Pope Innocent III. with orders to incite Catholic princes and people to extirpate heretics. Pope Gregory IX. in 1233 completed the design of his predecessors, and the inquisition was successively introduced into several parts of Italy, and, with certain limitations, into some provinces of France. The tribunals of faith were admitted into Spain in the middle of the 13th century; it became firmly established toward the end of the 15th century, under Ferdinand and Isabella, who used it as a weapon to break the strength of the nobles, and to render the royal authority absolute. In the assembly of the states held at Toledo, 1480, the erection of the new tribunal was urged by the cardinal, and after some opposition established under the name of the general or supreme inquisition. The new court was opened in Seville in 1481. Torquemada, prior of the Dominican convent at Segovia, and father-confessor to the Cardinal Mendoza, had already been appointed by Ferdinand and Isabella the first grand inquisitor in 1478. The Dominican monastery at Seville soon became insufficient to contain the numerous prisoners, and more than 2000 persons are said to have been burned alive in the first year or two. The pope, however, opposed the establishment of the Spanish inquisition as the conversion of an ecclesiastical into a secular tribunal, and repeatedly summoned the inquisitor-general to Rome. Torquemada, instead of obeying, sent a friend to defend his cause, and in 1483 Sixtus IV. was obliged to yield and acknowledge Torquemada as inquisitor-general of Castile and Leon, and a later bull subjected Aragon, Valencia, and Sicily to the inquisitor-general of Castile. It is computed that there were in Spain above 20,000 officers of the inquisition, called familiars, who served as spies and informers. These posts were sought even by persons of rank, on account of the great privileges connected with them. The supreme tribunal, under the inquisitor-general, sat at Madrid. He was assisted by a council of six or seven, and there were various officials belonging to the court, the one specially appointed to carry on prosecutions being called the fiscal. As soon as an accuser appeared, and the fiscal had called upon the court to exercise their authority, an order was issued to seize the accused. If he did not appear at the third summons he was excommunicated. From the moment that the prisoner was in the power of the court he was cut off from the world. The advocate who was appointed to defend him could not speak to him except in the presence of the inquisitors. The accused was not confronted with the accuser nor the witnesses before the court, neither were they made known to him; and he was often subjected to the torture to extort a confession, or to explain circumstances which had not been fully explained by the witnesses. Imprisonment, often for life, scourging, and the loss of property, were the punishments to which the penitent was subjected. When sentence of death was pronounced against the accused the auto da fe, or ceremony of burning the heretic in public, was ordered. This usually took place on Sunday, between Trinity Sunday and Advent As "the church never pollutes herself with blood," a servant of the inquisition, at the close of the procession and ecclesiastical ceremonial preceding the execution of the sentence, gave each of those who had been sentenced a blow with the hand, to signify that the inquisition had no longer any power over them, and that the victims were abandoned (relaxados) to the secular arm. A civil officer, "who was affectionately charged to treat them kindly and mercifully," now received the condemned, bound them with chains, and led them to the place of execution. They were then asked in what faith they would die. Those who answered the Catholic were first strangled; the rest were burned alive. The powers of the inquisition latterly became more limited, however, by various restrictions and at last, under Joseph Bonaparte, it was abolished altogether in 1808. It was re-established in 1814 by Ferdinand VII., but on the adoption of the constitution of the Cortes in 1820 it was again abolished. According to the estimate of its historian, Llorente, the number of victims of the Spanish Inquisition from 1481 to 1808 amounted to 341,021. Of these nearly 32,000 were burned.

INSANITY, a general term comprising every form of intellectual disorder, whether consisting in a total want or alienation of understanding, as in idiocy, or in the diseased state of one or several of the faculties. Medical writers have adopted different systems of classification in their treatment of this subject; but perhaps the most convenient is that which comprises all mental diseases under the four heads of mania, melancholy, dementia or fatuity, and idiocy. Idiocy is either a congenital or an acquired defect of the intellectual faculties. Congenital idiocy may originate from a malformation of the cranium, or of the brain itself. Acquired idiocy proceeds from mechanical injury of the cranium, or from injury or disease of the brain from excess in sexual indulgences, etc. (See Idiot.) Dementia is marked confusion of thoughts, loss of memory, childishness, a diminution or loss of the powers of volition, and general weak-mindedness; it differs from idiocy in being curable. Cretinism, sometimes given as a separate category, is a form of idiocy associated with a characteristic malformation of the body. Mania is a species of mental derangement characterized by the disorder of one or several of the facultics, or by a blind impulse to acts of fury. Adults are the principal subjects. Females are more exposed to it than males. Violent emotions, a dissipated life, excess in any indulgence, sometimes produce it. It is sometimes cured, but sometimes remains stationary, and sometimes is converted into dementia. Melancholy is a species of mental disorder consisting in a depression of spirits. Some dark or mournful idea occupies the mind exclusively, so that by degrees it becomes unable to judge rightly of existing circumstances, and the faculties are disturbed in their functions. Several kinds of melancholy are distinguished; the distinctions are founded, however, mostly on the causes of the disease, among the more important of which are love, religious views, repeated failures to reach an earnestly desired end, a sudden nervous shock, and the like. The course of the disease is various; sometimes it lasts a series of years; sometimes it ceases of itself, or is cured by medical aid. Very frequently melancholic patients commit suicide, a tendency that is not to be overlooked. In it also bodily health is likely to be neglected, thus leading to certain other diseases. See Lunatic Asylum, Lunacy, Non compos mentis, etc.

INSECTIV'ORA, an order of mammals living to a great extent on insects. They are plantigrade, and have a well-developed cavicle, a discoidal placenta, incisor teeth larger than the canine, and molar teeth set with sharp conical cusps. They are usually of small size, and many of them live underground, hibernating for some months. They are found throughout the world, with the exception of Australia and South America. The chief insectivorous families are the Talidæ ormoles, the Soricidæ or shrew-mice and the Erinaccidæ or hedgehogs.

INSECTIVOROUS PLANTS, plants which derive nourishment directly from the bodies of insects entrapped by them in various ways. See Dionæa, Sun-dew, Pitcher-plant.

INSECT POWDER, a brownish yellow powder obtained by grinding the dried flower heads of two species of chrysanthemum. The volatile oil then obtained acts upon the insects by asphyxiation; upon man and other animals it has no serious effect.

INSECTS. See Entomology.

INSESSO'RES, in ornithology, the perchers or passerine birds, an extensive order of birds comprehending all those which live habitually among trees, with the exception of the birds of prey and the climbing birds. The toes, which are three before and one behind, are specially adapted for perching and nest-building. These birds live in pairs, build in trees, and generally display great art in the construction of their nests. In them the organ of the voice attains its utmost complexity, and all our singing birds belong to the order. The form of the beak varies widely, and this has led to the establishment of four important subordinate groups. (1) The Conirostres, or "conical beaked" Insessores; (2) The Dentirostres or "tooth-beaked" perchers; (3) The Tenuirostres, or slender-beaked perchers; (4) The Fissirostres or cleft-beaks (swallows, swifts, goat-suckers, etc.). In modern classification the Fissirostres are generally excluded from the order, which is also divided otherwise. Two main divisions, the Acromyodi or singing-birds and the Mesomyodi or songless birds, are now generally recognized, the distinctive characters being based on the structure of the larynx. The former, again, are divided into the Turdiformes, or thrush-like birds; the Fringilliformes, or finch-like birds; and the Sturniformes, or starling-like birds. See also Ornithology.

INSOMNIA, or **SLEEPLESSNESS,** caused by mental or physical exhaustion, toxic conditions (as from alcohol or from disordered digestion), grief, etc. It is best treated by attacking and removing the cause, if this can be ascertained. Hygienic measures, as hot baths, massage, ingesting hot food, applying heat to the extremities, ventilating he sleeping apartment, etc., should be tried before resorting to drugs, to overcome the condition.

INSPIRATION, in theology, is the infusion of ideas into the human mind by the Holy Spirit. By the inspiration of the scriptures is meant the influence of the Holy Spirit exercised on the understandings, imaginations, memories, and other mental faculties of the writers, by means of which they were qualified for communicating to the world divine revelation, or the knowledge of the will of God.

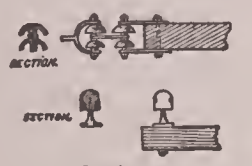
INSTINCT, the power by which, independently of all instruction or experience, and without deliberation, animals are directed to do spontaneously whatever is necessary for the preservation of the individual, or the continuation of the kind. Three main theories have been held with regard to instinctive actions: —(1) That these various impulses and faculties were bestowed by the Creator upon each species as its necessary and characteristic outfit. (2) That instinct is the accumulated results of individual experience, fixed by repetition, and transmitted as an inheritance to succeeding races. In this view instinct is intelligent in its origin, an organized experience, a "lapsed intelligence." (3) That the greater number of complex instincts arise through the natural selection of variations of simpler instinctive actions—variations arising from unknown causes The last theory is that of Darwin.

INSTITUTE OF FRANCE, the principal philosophical and literary society of France, organized after the first storm of the French Revolution in 1795, to replace the Académie Française, the Académie des Sciences, and the Académie des Belles Lettres et Inscriptions, its object being the advancement of the arts and sciences. The Institute now embraces five distinct divisions or académies, each having a separate field of knowledge or thought. (1) The Académie Française, originally established early in the 17th century. Its department is the French language and literature, and its ordinary members number 40. (2) The Académie des Inscriptions et Belles Lettres; ordinary members, 40. (3) The Académie des Sciences; ordinary members, 65. (4) The Académie des Beaux Arts; ordinary members, 40. (5) The Academie des Sciences, Morales, et Politiques; ordinary members, 40. Each academy has an independent organization and a free disposition of the funds committed to it. Members are elected for life by ballot, and have an annual salary of 1500 francs. To each academy are attached a certain number of honorary members and foreign associates. Admission into the Académie Française is a great object of ambition with most French literary men. The name of this distinguished body was changed in 1848 to Institut de France having previously been called National, Imperial, and Royal at different times.

INSTRUMENT, in music, any mechanical contrivance for the production of musical sound. Musical instruments are divided into three kinds—wind-instruments, stringed instruments, and instruments of percussion. The chief modern stringed instruments are the violin, viola, violoncello, and double bass, the harp, mandolin, guitar, and piano: the chief wind-instruments, the flute, oboe, bassoon, clarinet, basset-horn, serpent horn, trumpet, trombone, ophicleide, and organ; the chief percussion instruments, the drum, tambourine, cymbals, and triangle.

INSTRUMENTAL MUSIC, music produced by instruments, as contradistinguished from vocal music. Instrumentation is quite a modern art, and may be said to have been first cultivated to any purpose among the Italians, who up till the middle of last century, however, used only instruments of the viol kind, and who even yet are sparing in their use of wind-instruments. In Italy, Leo, Durante, Jomelli, and Majo; in France, Rameau; in Germany, Haydn and Mozart, deserve the credit of carrying the art to a perfection up to their time undreamed of. Further developments of an important character are due to Berlioz and Wagner.

IN'SULATOR, a body used to separate an electrified conductor from other bodies, and which offers very great resistance to the passage of electricity.



Insulator

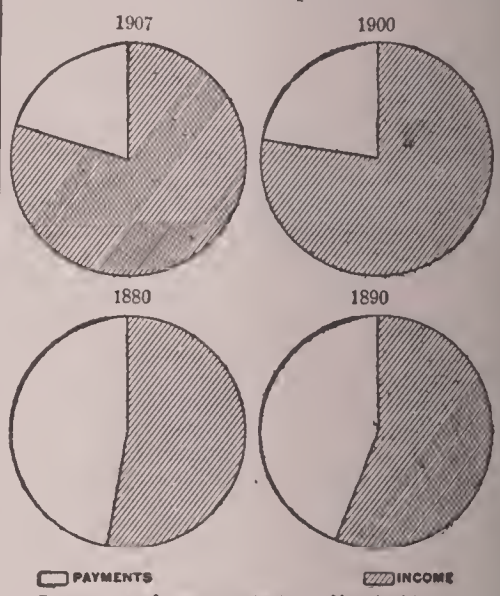
Glass, shellac, resins, sulphur, ebonite, gutta-percha, silk, and baked wood are notable insulating materials. The cut shows the usual forms of insulators in telegraph lines to support the wires on the posts. They are usually made of porcelain or glass.

INSU'RANCE, a contract by which an association, copartnership, or corporation engages for the payment of so much money, to insure the loser against loss of property by disaster at sea, earthquake, fire, or flood, against accident, or against ill-health. Life insurance is a contract under which the party insured receives either an annuity or a specified sum of money after the payment of annual premiums for a certain specified term of years; or under which his estate or any person he may name as his beneficiary will receive a specified sum after his death.

Insurance in the modern meaning of the word is divided into several classes, viz.: Marine, fire, accident, health, and life. Each of these subdivisions has been built up along certain generally recognized financial laws.

Life Insurance has been a recognized factor in social economy for more than 300 years. The first life insurance policy of which there is any record was issued in London in 1583, insuring the life of one William Gybbons for a period of twelves months, at the rate of $80 per $1,000. This policy was underwritten by thirteen persons acting individually. It was not until 1699, however, that a life insurance company was formed. In that year the members of the Mercers company, of London, formed a mutual association for the payment of benefits to widows and orphans of the members of the company. In 1706 the Amicable Society for a perpetual insurance was founded in London, and this company continued in existence until 1867, a period of 161 years. The London assurance corporation and the Royal exchange assurance corporation began business in London in 1721 and still survives.

The first life insurance company to be established in the United States was founded in Philadelphia in 1759. It was called the Presbyterian Annuity & Life Insurance company, and under the name of the Presbyterian Ministers' Fund Life Insurance company it still exists. Other ministerial companies were established in 1769, and in 1784. The first general life insurance company, the Pennsylvania company for insurance upon lives and granting annuities, was chartered in Philadelphia in 1812. The Massachusetts Hospital Life Insurance company was chartered at Boston in 1818. Beginning with the year 1840 some of the now existing life insurance companies were chartered, including: Mutual Life of New York, 1842; State Mutual of Worcester, Mass., 1844; Nautilus insurance company (now the New York Life), 1845; Connecticut Mutual of Hartford, 1846; Pennsylvania Mutual of Philadelphia, 1847.



Income and payments to policy holders.

From these beginnings the business of life insurance has made such enormous strides in the United States that already it overshadows all other financial interests. There are eighty life insurance companies in the United States. On Dec. 31, 1906, they had outstanding policies representing $13,706,797,784. Their aggregate annual premium receipts were $632,446,618.

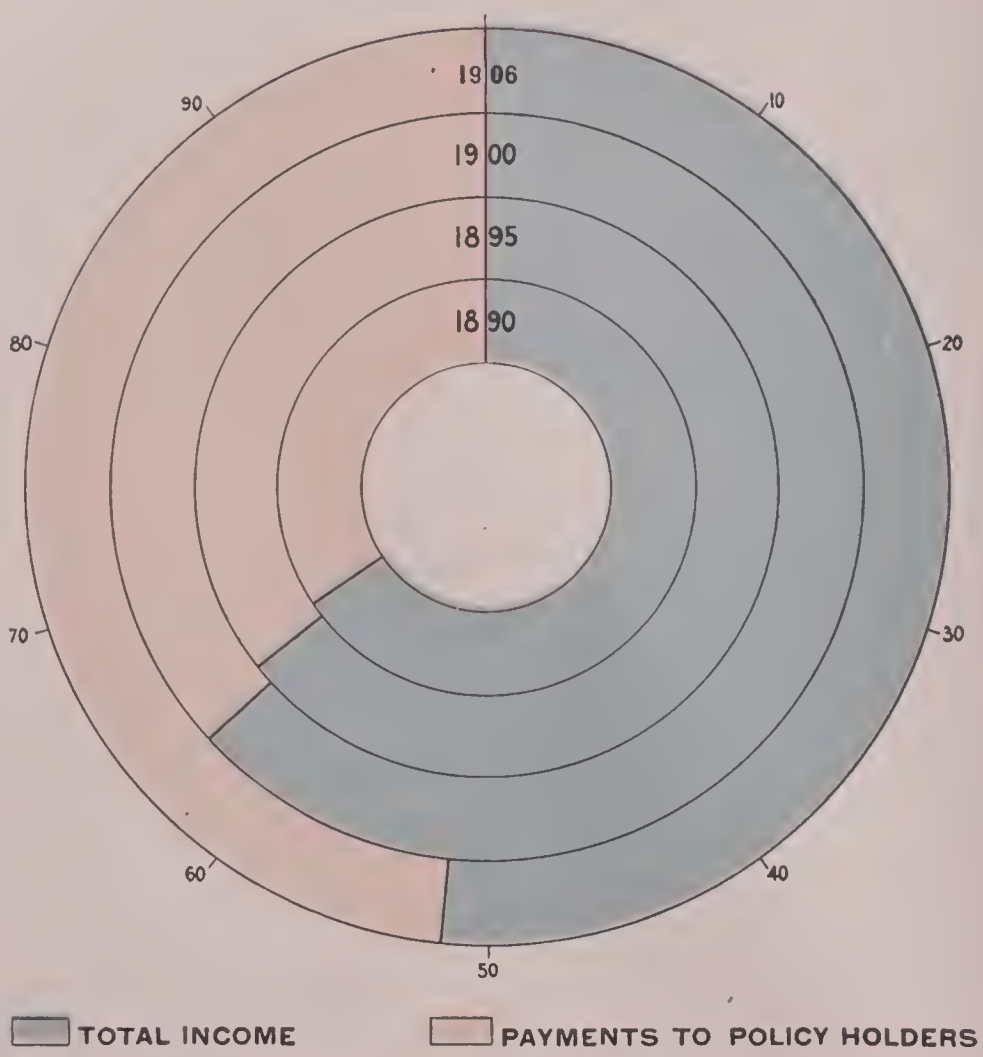
Life insurance, from a crude beginning has been developed into one of the most exacting sciences known in the realm of finance. In fact, it is a science in itself. It is a science based on natural laws gov-

LIFE INSURANCE

INCOME AND PAYMENTS TO POLICY HOLDERS

FIRE INSURANCE

1890-1909



erning the mortality of the human race, by which may be computed the average lifetime, and the premium to be paid on the policy. Included in the science of life insurance are mortality tables, the calculation of premiums, the loading of premiums, the medical examination, termination of policies, lapses and surrenders, surplus, reserve, nonforfeiture laws, tontines and surrender privileges.

Mortality Tables—As a result of a systematic study of mortality records, life insurance companies have incorporated the results of their computations into what are called mortality tables.

AMERICAN EXPERIENCE TABLE OF MORTALITY.

Completed Age.	Number Surviving at Each Age.	Deaths in Each Year.	Number of Years Expectation.	Number Dying Annually Out of Each 1,000.	Completed Age.	Number Surviving at Each Age.	Deaths in Each Year.	Number of Years Expectation.	Number Dying Annually Out of Each 1,000.
10	100,000	749	48.7	7.49	55	64,563	1,199	17.4	18.57
11	99,251	746	48.1	7.52	56	63,364	1,260	16.7	19.89
12	98,505	743	47.4	7.54	57	62,104	1,325	16.1	21.34
13	97,762	740	46.8	7.57	58	60,779	1,394	15.4	22.94
14	97,022	737	46.2	7.60	59	59,385	1,468	14.7	24.72
15	96,285	735	45.5	7.63	60	57,917	1,546	14.1	26.69
16	95,550	732	44.9	7.66	61	56,371	1,628	13.5	28.88
17	94,818	728	44.2	7.69	62	54,743	1,713	12.9	31.29
18	94,089	727	43 5	7.73	63	53,030	1,800	12.3	33.94
19	93,362	725	42.9	7.77	64	51,230	1,889	11.7	36.87
20	92,637	723	42.2	7.81	65	49,341	1,980	11.1	40.13
21	91,914	722	41.5	7.86	66	47,361	2,070	10.5	43.71
22	91,192	721	40.9	7.91	67	45,291	2,158	10.0	47.65
23	90,471	720	40.2	7.96	68	43,133	2,243	9.5	52.00
24	89,751	719	39.5	8.01	69	40,890	2,321	9.0	56.76
25	89,032	718	38.8	8.07	70	38,569	2,391	8.5	61.99
26	88,314	718	38.1	8.13	71	36,178	2,448	8.0	67.67
27	87,596	718	37.4	8.20	72	33,730	2,487	7.6	73.73
28	86,878	718	36.7	8.26	73	31,243	2,505	7.1	80.18
29	86,160	719	36.0	8.35	74	28,738	2,501	6.7	87.03
30	85,441	720	35.3	8.43	75	26,237	2,476	6.3	94.37
31	84,721	721	34.6	8.51	76	23,761	2,431	5.9	102.31
32	84,000	723	33.9	8.61	77	21,330	2,369	5.5	111.06
33	83,277	726	33.2	8.72	78	18,961	2,291	5.1	120.83
34	82,551	729	32.5	8.83	79	16,670	2,196	4.8	131.73
35	81,822	732	31.8	8.95	80	14,474	2,091	4.4	144.47
36	81,090	737	31.1	9.09	81	12,383	1,964	4.1	158.61
37	80,353	747	30.4	9.23	82	10,419	1,816	3.7	174.30
38	79,611	749	29.6	9.41	83	8,603	1,648	3.4	191.56
39	78,862	756	28.9	9.59	84	6,955	1,470	3.1	211.36
40	78,106	765	28.2	9.79	85	5,485	1,292	2.8	235.55
41	77,341	774	27.5	10.01	86	4,193	1,114	2.5	265.68
42	76,567	785	26.7	10.25	87	3,079	933	2.2	303.02
43	75,782	797	26.0	10.52	88	2,146	744	1.9	346.69
44	74,985	812	25.3	10.83	89	1,402	555	1.7	395.86
45	74,173	828	24.5	11.16	90	847	385	1.4	454.55
46	73,345	848	23.8	11.56	91	462	246	1.2	532.47
47	72,497	870	23.1	12.00	92	216	137	1.0	634.26
48	71,627	896	22.4	12.51	93	79	58	.8	734.18
49	70,731	927	21.6	13.11	94	21	18	.6	857.14
50	69,804	962	20.9	13.78	95	3	3	.5	1,000.00
51	68,842	1,001	20.2	14.54					
52	67,841	1,044	19.5	15.39					
53	66,797	1,091	18.8	16.33					
54	65,706	1,143	18.1	17.40					

These tables reveal at a glance the inexorable wordings of natural laws governing the length of human life. They show how many in any large number of persons born will live to reach the age of 30, how many to 36, to 40, to 60, in fact, to any reasonable age. They also show the number that will die at each age, and the average lifetime remaining to those who live.

By means of these mortuary tables all the other problems pertaining to life insurance are worked out. The mortuary tables, therefore, form the foundations of the life insurance business. The mortality table commonly in use in the United States is known as the American Experience Table of Mortality. The English companies use what is known as the Actuaries, or Combined, Experience Tables.

The Policy—There are many forms and varieties of policies, many companies having policies containing special features. The principal forms of policies in general use, however, may be designated as follows:

(a) Straight life, or limited life, in which the amount is paid to the estate of the insured at his death.

(b) Ten, fifteen, or twenty payment in which the insured receives the full amount of his policy at the end of 10, 15, or 20 years, if living, or his estate receives it upon his death at any time previous to the specified term.

(c) Endowment, another name for ten, fifteen, or twenty payment policies.

The Premium is the amount of money the insured pays to the company annually. It is computed by means of the mortality tables and is fixed at an amount designed to cover the mortality losses of the company, the expenses, etc. The premium is composed of two parts, viz., the net premium. and the loading, both constituting what is known technically as the gross premium. The net premium is the amount which is mathematically necessary for the creation of a fund large enough to enable the company to pay the policy in full at maturity. The loading is the amount added to the net premium to provide not only for the easily ascertained expenses, such as salaries for officers and commissions for agents, but to provide for all contingencies, such as a mortality in excess of the tabular rate, depreciation in the valuc of securities, and loss of invested funds.

The Reserve in life insurance is simply the insurance or mortality fund of the company from which all losses are paid. It is made up of the net annual premium and the money these premiums will earn at 2½ per cent compound interest. The reserve can be used for no other purpose than the payment of death claims. The legal reserve is the amount the law requires the company to hold in order ot be solvent.

Medical Examination—Life insurance companies depend largely upon medical examinations to protect the mortality tables from deviation which might be caused by the admission of applicants whose average expectation of life might be lessened by unfavorable physical conditions. Among the facts elicited by medical examination are: Occupation, hereditary influence, existence of pulmonary tuberculosis or insanity, and evident tendency to disease.

Lapses and Surrenders—A policy is said to lapse when the insured fails to pay a prémium when it becomes due. A policy is surrendered when the insured gives formal notice of his desire to terminate the policy and receive its surrender value. Down to 1860 a policy holder who permitted his policy to lapse lost both surplus and reserve. Since 1861 legislation and competition protects the policy against such loss. Most, if not all, companies guarantee the policy holder his share of the reserve or the surrender value of his policy after three premiums have been paid.

INSURANCE, FIRE. See Fire Insurance.

INSURANCE SCANDALS, the revelations of extravagance and mismanagement in the conduct of the big life insurance companies of the United States during the years 1905–6 led to drastic reorganization, and changes in methods. The disclosures began in February, 1905, in a struggle between two factions for the control of the Equitable life assurance society, of New York James W. Alexander, president of the company, led the faction of the stock and policy holders which demanded that the company be mutualized so that the policy holders could be represented on the board of directors. This demand was resisted by a faction led by James Hazen Hyde, vice-president of the company, and son of its founder.

The struggle brought to public light a scandalous state of affairs, showing that funds had been used to further stock jobbing schemes in Wall street and for other questionable transactions. As a result, Alexander and Hyde both were forced out of the company. Hyde, who owned a majority of the stock, sold it to Thomas F. Ryan, a New York capitalist, who placed it in the hands of three trustees, Grover Cleveland, Morgan T. O'Brien, and George Westinghouse. Paul Morton was elected president of the company on July 26. He reorganized its methods and instituted many reforms.

On Sept. 6, 1905, a New York legislative committee, known as the Armstrong committee, with Charles E. Hughes, a New York attorney, as chief counsel, began a general investigation of all the big life insurance companies chartered by the state of New York.

The principal companies subjected to a searching investigation were the Equitable, the Mutual and the New York Life. The disclosures startled the whole country. It was shown that the New York Life had contributed $150,000 to political campaign funds; that it had permitted one Andrew Hamilton to expend $1,347,382 for work in "influencing" legislation. The revelations involved John H. McCall, president of the company. He sold everything he had in the world, repaid $235,000 and died a broken-hearted, penniless man.

It was shown that President Richard A. McCurdy, of the Mutual was drawing a salary of $150,000 per annum and that the funds of the company were being used by banks and trust companies con-

trolled by McCurdy. His son Robert and his son-in-law, L. A. Thebaud, had been paid millions in "commissions." As a result the McCurdy family was ousted from the Mutual. Charles A. Peabody was elected president.

The Armstrong committee made an exhaustive report and recommended the passage of nine laws to prevent a recurrence of the scandals. The laws are now on the New York statute books.

INTAGLIO (in-tal'yō), a stone or gem on which a figure is hollowed out so that the impression from it may be in relief; the opposite of cameo.

IN'TEGRAL CALCULUS. See Calculus.

INTELLECT, the name for the thinking portion of our mental constitution. Mind contains three elementary constituents,—emotion or feeling, volition or the will, and intelligence or thought. The intellectual powers are explained in part by their contrast with feeling and will. When we enjoy pleasure or suffer pain, we are said to feel; when we act to procure one or avoid the other, we put forth voluntary energy; when we remember, compare, reason, our intelligence is exerted. The powers of the intellect have been variously classified. Among the commonly recognized designations for them, me may mention memory, reason, and imagination, which imply three very distinct applications of our mental forces. Reid classified them as follows: Perception by the senses, memory, conception, abstraction, judgment, reasoning. Stewart added consciousness, to denote the power of recognizing our mental states, as sensation and perception make us cognizant of the outer world; likewise attention (a purely voluntary function, although exerted in the domain of intelligence), imagination, and the association of ideas.

INTEMPERANCE. See Temperance.

INTERCESSION, DOCTRINE OF.—Scripture, in many places, represents Christ, after having finished his redemptive work on earth, and ascended into his state of glory and exaltation, as ever pleading with God on behalf of those whom he has redeemed by the shedding of his blood (Rom. viii, 34; Heb. vii, 25; I. John ii, 1). Theologians say, however, that we are not to suppose that God needs to be interceded with, as if he were still reluctant to forgive men, or that Christ's intercession makes him more merciful than before. They tell us, that since it is evident from the whole tenor of the New Testament, as well as from a multitude of special passages, that the penal sacrifice of Christ on Calvary reconciled God to man, we must regard the intercessory work of Christ rather as serving to illustrate the eternal holiness of God and the changeless love of the Savior, and as intended to keep continually in view the sacrifice of atonement on which it is founded. The doctrine of the intercession of Christ is held both by Protestants and Roman Catholics; but the latter, in addition, believe in the efficacy of the intercession of the Virgin and the saints, who, however, do not directly intercede for men with God, but with the Savior, the sinless One, who alone has the ear of the King of the universe.

IN'TERDICT, an ecclesiastical censure in the Roman Catholic Church, the effect of which, taken in its most extended sense, is, that no kind of divine service is celebrated in the place or country under the sentence; the sacraments are not administered, the dead not buried with the rites of the church. This interdict is called real or local, whilst the personal interdict regards only one or more persons. Gregory VII., though not the inventor of this engine of ecclesiastical power, used it oftener and more tyrannically than any of his predecessors. The 11th century was pre-eminently the century of interdicts, but they gradually lost power; and when Paul V. laid Venice under an interdict in 1606 the churches were not closed nor divine service interrupted, and only a minority of the bishops acknowledged it. The interdict must be announced, like the excommunication, in writing, with the causes, and is not to be imposed until after three admonitions. The penalty of disobedience to an interdict is excommunication. Writers of the Gallican Church say that the pope has no right to lay France under an interdict, and the parliaments refused to register them. Interdicts are not to be confounded with the simple cessatio a divinis, or the disuse of religious ceremonies, which takes place when a church has been polluted, for example, by a murder committed in it.

INTEREST, is the allowance made for the loan or retention of a sum of money which is lent for, or becomes due at, a certain time; this allowance being generally estimated at so much per cent per annum. The money lent is called the principal; the sum paid for the use of it, the interest. The interest of $100 for one year is called the rate per cent, and the sum of any principal and its interest together, the amount. Interest is either simple or compound. Simple interest is that which is allowed upon the principal only, for the whole time of the loan. Compound interest is that which arises from any sum or principal in a given time by increasing the principal, at fixed periods, by the interest then due, and hence obtaining interest upon both interest and principal. The rate of interest supposing the security for the principal to be equal, depends obviously upon what may be made by the employment of money in various industrious undertakings, or on the rate of profit. Where profits are high, interest is high, and vice versa; in fact, the rate of interest is simply the net profit on capital. Besides this, however, the interest on each particular loan must further vary according to the supposed risk of the lender, the supposed solvency of the borrower, etc.

INTERFE'RENCE, in physics, the mutual action of waves of any kind (whether those in water, or sound, heat, or light waves) upon each other, by which, in certain circumstances, the vibrations and their effects are increased, diminished, or neutralized. When two minute pencils of light, radiating from two different luminous points, and making a small angle with each other, fall upon the same spot of a screen or a piece of paper, it is found that in some cases they illuminate the paper or screen more strongly than either would have done singly, and sometimes they destroy each other's effects and produce a black spot or fringe. Such phenomena have been explained in accordance with the undulatory theory of light, and furnish a strong argument in favor of that theory. The interference of waves of sound is a phenomenon which may be frequently observed in the beat of the tone of the heavier organ pipes. Again, to a person situated in the middle of a bell the sound waves from the vibrating segments of the bell interfere and produce only a moderate loudness, whereas to a person at a short distance outside the edge the loudness is intolerable.

INTERIOR, Department of the, one of the ten executive departments of the United States government, whose chiefs constitute the president's cabinet. It was organized in 1849. It has supervision of Indian affairs; of the public lands, including mines; of pensions; of patents; of the census, when directed by law; of the geological survey; of education; of the custody and distribution of public documents; of railroads which have received subsidies from the United States; of the territories; of national parks and reservations; of some charitable and penal institutions in the District of Columbia; of the returns office in which are filed returns of contracts made by the secretary of war, the secretary of the navy, and the secretary of the interior, and of some other miscellaneous business.

INTERMARRIAGE, the intermarriage of near relations has been universally believed to result in degeneration upon the offspring. The gradual deterioration of the slave population of America have been attributed to consanguineous alliances. The same is true of deafmutism or idiocy; of 235 deaf and dumb children whose parentage could be traced 30 per cent were the offspring of the intermarriage of blood-relations. Insanity follows consanguineous marriages where the contracting parties inherit the same tendencies of a neurotic nature.

INTER'MENT. See Burial.

INTERMITTENT FEVER. See Ague.

INTERNATIONAL LAW, the law of nations; those rules or maxims which independent political societies or states observe, or ought to observe, in their conduct toward one another. International law is divisible into two heads, the one which regulates the rights, intercourse, and obligations of nations, as such, with each other; the other, which regulates the rights and obligations more immediately belonging to their respective subjects. Thus the rights and duties of ambassadors belong to that head which respects the nation in its sovereign capacity; and the rights of the subjects of one nation to property situated within the territory of another nation, belong to the latter head. Some of the maxims regarding the rights and duties of nations during a state of peace are:—(1) Every nation is bound to abstain from all interference with the domains of other nations. (2) All nations have equal and common rights on the high seas, and they are not bound to admit any superiority there. The sea which washes the coast of a nation, to the

extent of three miles, is now deemed to be a part of the territory of the nation, over which it may exercise an exclusive jurisdiction. And, in respect to persons subjected to its laws, every nation now claims a right to exercise jurisdiction on the high seas, for the purpose of enforcing both international law and its own municipal regulations. (3) No nation has a right to persue any criminal or fugitive from justice in a foreign country; its claim, if any, is a mere right to demand him from the nation in which he has taken refuge. (4) Every nation has a right to regulate its own intercourse and commerce with other nations. (5) Foreigners are bound to obey the laws of a country as long as they reside within it, and under its protection; and the property held by foreigners within a country ought to be protected in the same manner as that of natives. (6) Every nation has a right to send and to receive ambassadors and other public ministers; and this right of embassy has always been deemed peculiarly sacred. Their persons are held sacred and inviolable. Their property and servants, and retinue enjoy a like privilege. (See Ambassador.) (7) It is through the medium of ambassadors and other public ministers that treaties, conventions, and other compacts between nations are usually negotiated, thus forming a positive code for the regulation of their mutual rights, duties, and interests. In the modern practice of nations such treaties and compacts are not generally deemed final and conclusive until they have been ratified by the respective governments to which the negotiators belong.

War introduces an entirely new order of rules. The right of declaring war results from the right of a nation to preserve its own existence, its own liberties, and its own essential interests. In a state of nature men have a right to employ force in self-defense; and when they enter into society this right is transferred to the government, and is an incident to sovereignty. What are just causes for entering into a war is a question which has been much discussed by publicists. Defensive wars are necessarily justifiable from the fact that they involve the existence or safety of the nation and its interests. But offensive wars are of a very different character, and can be justified only in case of aggravated wrongs or vital injuries. The first effect of a declaration of war is to put all the subjects of each of the nations in a state of hostility to each other. All the property belonging to each is deemed hostile. If it be personal property it may be captured as prize; if lands, it may be seized and confiscated at the pleasure of the sovereign; if it be merely in debts or stock it may, in the extreme exercise of the laws of war, be equally liable to confiscation. As soon as a battle is over the conquerors are bound to treat the wounded with kindness, and the prisoners with a decent humanity. And there are some things which seem positively prohibited from their cruelty and brutal barbarity; such are the violation of female captives, the torturing of prisoners, the poisoning of wells, the use of inhuman instruments of war. In time of war there is occasionally an intercourse between the belligerents which should always be held sacred. Thus the interchange of prisoners by cartels; the temporary suspension of hostilities by truces; the passage of flags of truce; the engaging in treaties of capitulation. When any conquest of territory is made the inhabitants pass under the dominion of the conqueror, and are subject to such laws as he chooses to impose upon them. There are also certain rights which war confers on the belligerents in respect to neutrals. Thus they have a right to blockade the ports or besiege the cities of their enemies, and to interdict all trade by neutrals with them. But no blockade is to be recognized unless "the besieging force can apply its power to every point in the blockaded state." They have a right also to insist that neutrals shall conduct themselves with good faith, and abstain from all interference in the contest by supplying their enemy with things contraband of war. And hence arises the incidental right of search of ships on the high seas for the detection of contraband goods. A neutral nation is bound to observe entire impartiality between the belligerents. Neutral nations are, strictly speaking, bound to compel their subjects to abstain from every interference in the war, as by carrying contraband goods, serving in the hostile army, furnishing supplies, etc. Subject to the exceptions above referred to, a neutral has a right to insist upon carrying on its ordinary commerce with each of the belligerents in the same manner as in times of peace. See Neutrality.

INTERNATIONAL PEACE CONFERENCE, a conference of one hundred and one delegates representing twenty-six countries of the world, held at The Hague from May 18 to July 29, 1899, in response of an invitation by the Czar of Russia to the governments of the principal states of the world for the purpose of concerted action with regard to international questions of peace and war, and to secure, if possible, a gradual reduction of the military and naval armaments of the states represented. See Hague Conference.

INTERNATIONAL PRISON CONGRESS, the first prison conference held in 1845 at Frankfort, the second in 1857. In 1870 the first American prison congress was held, and President Grant appointed Dr. Wines commissioner to arrange an international conference. The congress met in London in 1872. Meetings are now held at intervals of five years. The programmes are arranged by a permanent committee, the International penitentiary commission. Papers by experts are printed in advance, and form the bases of the discussions. The congresses have been held in various capitals, and have been productive of great good.

INTES'TACY, in law, the condition of a person who dies without having left any will at all, or having left one not legally valid, or such a will that nobody becomes heir under it. The general principle in Britain and the United States is that the law provides an heir or next of kin if the owner himself has not done so. In the case of a person dying partially intestate, the property not included in the settlement goes to the heir-at-law or next of kin according as it is real or personal estate.

INTES'TINE, the name given to the convoluted membranous tube which extends from the right or pyloric orifice of the stomach to the anus, and which receives the ingested food from the stomach, retains it for a longer or

Human stomach and intestinal tube.
a, Stomach.—*b* to *d*, Small intestine. *b*, Duodenum. *c*, Jejunum with convolutions. *d*, Ileum, with do. —*e* to *g*, Large intestine. *e*, Cœcum, *ff*, Colon. *g*, Rectum.

shorter period, mixes it with the bile, pancreatic juice, and intestinal secretions, gives origin to the lacteal or absorbent vessels which take up the chyle and convey it into the current of the blood, and which, lastly, conveys the fæcal or indigestible products from the system. In man it is usually divided into the small intestine, which comprehends the duodenum, jejunum, and ileum; and the large intestine, comprehending the cœcum, colon, and rectum. Three distinct coats are to be distinguished in the structure of the small intestine; these, named from without inward, are known as the serous, muscular, and mucous coats. The innermost or mucous coat presents several interesting structures. Among these are the valvulæ conniventes, or closely folded transverse plaits of the mucous membrane, the functions of which would appear to be those of serving materially to increase the digestive surface or area of the intestine, and thoroughly mingle the ingesta with the secretions. The surface of the membrane is covered with innumerable fine projections termed villi, which give to it almost a velvety texture.

Each villus is found under the microscope to be an outstanding process of the mucous membrane, containing internally an artery giving off minute ramifications, a vein by which the venous blood is returned, and, lastly, the lacteal or absorbent vessel. The function of the villi, which are most numerous in the duodenum, is pre-eminently that of the absorption of the chyle or fluid product of digestion, as a preliminary to its transmission to the current of the blood or circulation. Four varieties of glands are also connected with the small intestine, the first three being named after their respective discoverers, Lieberkühn, Peyer, and Brünner, and the other variety occurring singly—the "solitary"

glands—and in groups—Peyer's patches. The exact functions of these bodies are not well known. The duodenum lies in the epigastric region, and makes three turnings, receiving by a common opening between its first and second flexure the bile-duct and the pancreatic-duct. The conversion of the chyme from the stomach into chyle is thus accomplished in the duodenum. The jejunum, commencing at the left side of the second lumbar vertebra, becomes insensibly and gradually continuous with the ileum, which, terminating the small intertine, becomes continuous with the large intestine in the right iliac fossa, and opens into the colon, or first portion of the large intestine, which is divided from the large intestines by the ileo-cœcal valve. Below the point at which the ileum opens into the colon we find a short blind sac continuous with the colon, and known as the cœcum; and attached to the lower extremity of the cœcum, and communicating with the cœcal cavity, we find a little closed tube, to which the name of appendix vermiformis is applied. We next find the colon to ascend in the right lumbar region, in front of the kidney. This portion is known as the ascending colon. It then crosses the abdominal cavity to the left side, and becomes the transverse colon; and finally descends as the descending colon, in front of the left kidney into the left groin, where, after making a curve like the letter S—sigmoid flexure of the colon—it terminates in the last portion of the intestinal tract. This last portion, known as the rectum, finally terminates in the anus. The large intestine measures from 5 to 6 feet in length; the small intestine measures from 16 to about 24 or 26 feet in length; so that the entire intestinal tract may be regarded as being about five or six times the length of the body itself. The three coats of the small intestine are repeated in the large intestine. The mucous or inner coat is not elevated to form villi in the large, as in the small intestine, and only two kinds of glands, the glands of Lieberkühn, and the solitary glands, are to be distinguished in the large intestine. The function of the large intestine is chiefly excretory, but a certain power of absorption is also exercised by its vessels. The food is propelled along the entire intestinal tract by the alternate contraction of the longitudinal muscular fibers, by which means it is gradually pushed along the tube with a vermicular or peristaltic movement. The ileo-cœcal valve serves to prevent regurgitation of matters into the small intestine, after they have passed into the colon. The mesentery is the term given to the fold of peritoneum by means of which the small intertines are attached to the spine. The blood-vessels supplying the intestinal tube are the superior and inferior mesenteric arteries and their branches, derived from the abdominal aorta. The veins of the intestines empty their contents into the vena portæ, which distributes itself through the liver, and from the blood of which the bile is secreted by the hepatic or liver cells. The nerves of the intestines are derived from the sympathetic or ganglionic system of nerves, and also have a connection with the eighth cranial nerve—the pneumogastric nerve of the right side.

INTOXICATION, the state produced by the excessive use of alcoholic liquids. In the first stage the circulation of the blood becomes somewhat more rapid, and all the functions of the body and mind are exercised with more freedom. In the second stage the effect on the brain is more decided. The peculiarities of character, the faults of temperament, manifest themselves without reserve; the secret thoughts are disclosed, and the sense of propriety is lost. In the next degree consciousness is still more weakened; the ideas lose their connection; vertigo, double vision and other discomforts supervene; until finally the excitement partakes of the nature of delirium, and is followed by a more or less prolonged stupor, often by dangerous coma. In cases of extreme intoxication the stomach-pump should be employed, if ordinary emetics fail to overcome the torpor of the stomach. Among the best antidotes are preparations of ammonia and strong infusions of coffee and green tea. The body should be kept warm.

INTRENCHMENT, any work that fortifies a post against the attack of an enemy. The word is generally used to denote a ditch or trench with a parapet.

INTUI'TION, in philosophy, the act by which the mind perceives the agreement or disagreement of two ideas, or the truth of propositions, immediately, or the moment they are presented, without the intervention of other ideas, or without reasoning and deduction.

INVALIDES (aṇ-vȧ-lēd), Hôtel des, a splendid hospital for disabled soldiers at Paris, in the suburb of St. Germain, erected by Louis XIV. between 1670 and 1673. A soldier must have served ten years to be received into this hospital on account of poverty or infirmity. In vaults under the dome lie the remains of Turenne and several other great French commanders, including those of Napoleon I., deposited here December 15, 1840.

INVENTION OF THE CROSS. See Cross.

IN'VENTORY, a list containing a short description, together with the values, of goods and chattels, made on various occasions, as on the sale of goods, transfer of movables for pecuniary considerations, decease of a person, etc.

INVERNESS', a royal, parliamentary, and municipal burgh in Scotland, capital of the county of the same name, and chief town in the Highlands. Pop. 21,193.—The county is the largest in Scotland. Area, 4255 sq. miles, or 2,723,000 acres, of which only about 100,000 are under tillage. Pop. 90,182.

INVERTEBRA'TA, a collective term for the five great lower divisions or subkingdoms of the animal series, which agree in not having a vertebral column or back-bone, used in contradistinction to the highest group of the animal kingdom, to which the name Vertebrata or Vertebrate animals is given, all of which possess a vertebral column. In invertebrates no structure analogous to the vertebrate spine is found. Where hard parts exist in them they are generally placed on the outside of the body, and thus constitute an exo-skeleton, or outer skeleton—as opposed to the endo-skeleton, or internal skeleton of the vertebrata. The shell of the crab or lobster is a familiar example. The limbs or vertebrates are never more than four in number, while those of the invertebrata may be very numerous. Among vertebrates also reproducton is purely and solely sexual; but in invertebrata asexual reproduction is common, many of them reproducing their species by gemmation or budding, and by fission.

IN'VOICE, an account in writing of the particulars of merchandise transmitted to a purchaser, giving price and quantity, note of charges, and any other needful details. By sending an invoice along with goods a merchant gives official advice to his correspondent of the understood terms of a contract. If the goods are received and the invoice retained this will be held valid evidence in law of the contract.

INVOLU'CRE, in botany, a collection of bracts round a circle of flowers. In umbelliferous plants it consists of separate narrow bracts placed in a single whorl; in many composite plants these organs are imbricated in several rows. The same name is also given to the covering of the sori of ferns.

Hemlock plant—*a*, Involucre. *bb*, Involucels.

I'ODINE, a peculiar non-metallic elementary solid substance. It exists in the water of the ocean and mineral springs, in marine molluscous animals, and in sea-weeds, from the ashes of which it is chiefly procured (see Kelp). It exists also in certain land-plants and in cod-liver oil. It is found in certain minerals, the water of certain rivers, and the rain-water of several towns. At the ordinary temperature of the atmosphere it is a solid crystalline body. It unites readily with chlorine, potassium, etc., with the emission of light and great heat. It is a non-conductor of electricity, and, like oxygen and chlorine, is a negative electric. Like chlorine, it destroys vegetable colors, but with less energy. Its color is bluish black or grayish black, of a metallic lustre. It is often in scales, resembling those of micaceous iron ore; sometimes in brilliant rhomboidal plates or in elongated octahedrons. Its vapor is an exceedingly rich violet color, a character to which it owes its name. This vapor is remarkably dense. Iodine has a very acrid taste, and its odor resembles that of chlorine. It is an irritant poison; but in small doses has been of great service in certain forms of glandular disease. It is largely used in photography, in the preparation of aniline colors, and in other ways. It is very sparingly soluble in water, but dissolves copiously in alcohol and in ether, forming dark brown liquids. It possesses

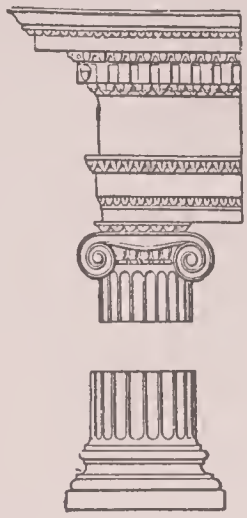
strong powers of combination, and forms, with the pure metals, and most of the simple non-metallic substances, compounds which are termed iodides. With hydrogen and oxygen it forms iodic acid; combined with hydrogen it forms hydriodic acid. This is a colorless gas, which strongly reddens litmus, and decomposes many chlorides. Starch is a characteristic test of iodine, forming with it a compound of a deep blue color. This test is so delicate that a solution of starch dropped into water containing less than a millionth part of iodine is tinged blue by it. The great consumption of iodine is in medicine; it is employed in its pure state, but much more frequently in the form of iodide of potassium, which has been found of great benefit in goitre, scrofula, disease of the liver and spleen, in syphilitic affections, rheumatism, etc., as well as in lead-poisoning. Iodide of iron is another useful medicine, being employed in chlorosis, anæmia, scrofula, and glandular affections.

IOD'OFORM, a substance analogous to chloroform in composition, but in which iodine replaces chlorine. It is in the form of small, solid yellow crystals, and is prepared by the action of alcohol and other bodies on iodine and potash. It is nearly insoluble in water, but dissolves in ether oils and alcohol. It is used in medicine as an antiseptic, and acts slightly as an anodyne; it is successfully applied to ulcers and sores of various kinds, and is used as a snuff for cold in the head. It may be prepared as an ointment.

IONIA, that part of the seaboard of Asia Minor which was inhabited by Ionian Greeks, a beautiful and fertile country opposite the islands of Samos and Chios, which also belonged to it. According to tradition the Greek colonists came over from Attica about the middle of the 11th century B. C., and founded twelve towns, which, though mutually independent, formed a confederacy for common purposes. These included Phocæa, Ephesus, Miletus, etc., and latterly Smyrna. Commerce, navigation, and agriculture early rendered them wealthy and flourishing, but the country was made tributary by Crœsus, king of Lydia, and later by Cyrus, king of Persia (557 B. C.). With an interval of independence they remained under Persia until this empire was overthrown by Alexander the Great, 334–331 B. C., when they became a part of the Macedonian Empire. Ionia, at a later period, became part of the Roman province of Asia. It was afterward totally devastated by the Saracens, so that few vestiges of its ancient civilization remain.

IONIAN ISLANDS, a number of Greek islands in the Ionian sea, extending along the western and southern shores of Greece, of which the largest are Corfu, Cephalonia, Zante, and Cerigo, others being Ithaca or Thiaki, Paxos, and Santa Maura; area, 1097 sq. miles. Pop. 252,000.

IONIC ORDER, one of the orders of classic architecture, the distinguishing characteristic of which is the volutes of its capital. In the Grecian Ionic (1) the stylobate consists of three receding equal steps the combined height of which is from four-fifths to a whole diameter; (2) the column, which includes band, shaft, and capital, is rather more than nine diameters in height, the shaft being fluted with twenty-four flutes and alternating fillets; while (3) the entablature



Ionic order—Grecian.

is rather more than two diameters in height. The volutes are connected on the flanks by a peculiar roll-moulding, called the baluster or bolster. In the Roman Ionic, a modification of the latter style, the stylobate is lofty and not graduated; the shaft diminishes one-

The Erechtheum at Athens—Ionic order.

tenth of a diameter and has twenty fillets and flutes; the capital, which is two-fifths of a diameter, has its volutes a little lower than the other, and a square abacus with moulded edges covers the whole. The chief examples of the Grecian Ionic are those of the Athenian

Ionic architecture—Temple of Wingless Victory, on the Acropolis of Athens.

Acropolis; while those of the Roman Ionic are found in the temple of Fortuna Virilis and the Coliseum at Rome.

IOU, a written acknowledgment of debt, usually made in this form:—"To Mr. A. B. I O U Ten dollars.—C. D. May 12th, 1898." An acknowledgment of debt made in this form requires no stamp. It is not negotiable. The letters IOU are of course used instead of the words "I owe you."

I'OWA, one of the central United States, bounded on the north by Minnesota; east by Wisconsin and Illinois, from which it is separated by the Mississippi; south by Missouri; and west by Nebraska and Dakota, from which it is separated by the river Missouri; area, 56,025 sq. miles. It is well watered, its streams being all affluents of the large rivers which bound it on the west and east. To the Mississippi flow the Wapsipincon, Iowa, Cedar, Skunk, and Des Moines, with a general s. e. course To the Missouri flow the Big and Little Sioux and other streams. The surface is undulating, nearly four-fifths consisting of prairies covered with a rich coat of coarse grass, forming excellent pasturage. The climate is very healthy, and winter continues from December to March; the summer heat is tempered by frequent showers. The soil is in general very good, consisting of a deep black mould, intermingled in the prairies with sand, red clay, and gravel. The eastern portion is rich in minerals.

Iowa's most valuable mineral resources are the bituminous coal beds in the south-

Seal of Iowa.

eastern quarter of the state, the lead and zinc ores in the Galena limestone of the lower Silurian formation of the northeast. Extensive deposits of gypsum are also found, and various other minerals. The limestones of the Devonian and upper Silurian formations furnish an inexhaustible supply of building-stone of the finest quality. Clays suitable for brick manufacture are abundant and are extensively ulitized. Small quantities of zinc and gypsum are mined.

The area occupied by forests and woodland is about 5,000,000 acres.

Iowa is pre-eminently an agricultural state. Of its total land area, 97.4 per cent is included in farms, and of this, 86.5 per cent is improved. The soil is well drained, producing abundantly without the aid of artificial fertilizers. The state is noted especially for its corn crops, the acreage for which amounts to over one-fourth of its total area, and contributes about one-half of the total value for all crops. Oats rank next in importance, with about one-half the acreage and one-third the value of corn. The state usually takes first place in the production of this cereal. Wheat is raised most extensively

in the northern and northwestern counties. The state ranks second in the production of barley, this crop also being most extensively grown in the northern part. Less important cereals are rye and buckwheat. The soil is well adapted to vegetables, and the state ranks second in the production of Irish potatoes. The fruit industry is rapidly developing. Over 71 per cent of the total are apple-trees. Grapes and small fruits are successfully grown.

Stock-raising holds a higher rank than the raising of crops. Texas alone rivals Iowa in the value of live stock, and is the only state which exceeds it in the number of cattle. Iowa is far in advance of all others in the number of swine, and leads also in the number of horses. Other industries include the manufacture of farm implements, flour-milling, pork-packing, machinery, smelting-works, etc. The length of railways open for traffic is over 10,000 miles. It possesses exceptional advantages for river trade, and the smaller streams supply abundant water-power. Education is well attended to. There is a state university (at Iowa City) and a flourishing state agricultural college.

Marquette and Joliet, in 1673, and Hennepin, in 1680, touched on the boarders of the state. In 1803 the region passed to the United States as a part of the Louisiana cession, and Indian titles to the land were extinguished by treaties in the years 1804, 1832, and subsequently. It formed, in turn, a part of the territories of Louisiana (organized in 1804), Missouri, Michigan, and Wisconsin. On June 12, 1838, it was organized as the Iowa territory. In 1839 the government was removed to Iowa City, and in 1844 a state constitution was framed and admission to the Union sought for. The state was admitted to the Union on December 28, 1846. In 1857 the original constitution of 1846 was revised and Des Moines was made the capital. In the civil war, Iowa, whose fundamental law prohibited slavery, took a zealous part. The two most important questions of public moment since 1870 have been railway legislation and prohibition. The development of the state was greatly accelerated by the building of railroads, of which there were, in 1900, nearly 10,000 miles, but with the rise of powerful railway corporations, there ensued a continuous conflict between the legislature and the companies in regard to the taxation of railway property and the regulation of rates. In 1872 an act taxing railway property was passed, and in 1873 a powerful agitation stirred up by the patrons of husbandry against the extortionate rates imposed by the companies led to the creation of a board of railroad comissioners for the purpose of determining a maximum rate and preventing discrimination. Radical action on the part of the commissioners caused repeated appeals to the courts, and though many concessions were wrung from the companies, the advantage in general remained with them. A prohibition amendment adopted in 1882 was promptly declared unconstitutional by the courts. A new law went into effect in 1884, and for some years proved fairly adequate. A very large part of the population, however, was opposed to sumptuary legislation, and in 1890, under the protection of the interstate commerce laws, a successful attempt was made to evade the anti-liquor regulations by the importation of alcoholic products from other states. In 1894 the courts declared the prohibitory laws unconstitutional. From 1846 to 1854 the state was Democratic both in national and state politics. Since 1854 its vote in national elections has always been cast for the republican candidate. The capital is Des Moines; the principal towns being Dubuque, Davenport, Burlington, Council Bluffs, Sioux City, Cedar Rapids, and Keokuk, Pop. 1909. 2.232,000.

IOWA, a river in the state of Iowa, rising in Hancock co., near the Minnesota line, and flowing southeast into the Mississippi, 35 miles north of Burlington. It is 100 miles long and navigable to Iowa City, 800 miles from its mouth.

IOWA, State University of, an educational institution for both sexes in Iowa City, Iowa. The institution was opened in 1855 and re-organized in 1860. The work of the university is organized in a college of liberal arts, colleges of law, medicine, homeopathic medicine, dentistry and pharmacy, a graduate department, the Iowa school of political and social science, and two hospitals. The college of liberal arts confers the degrees of B.A., B.Ph., and B.S. The graduate college confers the degrees of M.A., M.S., Ph.D., civil engineer, and electrical engineer. The college of liberal arts maintains a summer session for teachers and a summer school for library training. The university provides public lectures and extension courses, and is in close touch with the educational institutions of the state through its system of accredited high schools.

IOWA CITY, a city, the capital of Johnson co., Iowa, on the river Iowa, at the head of navigation. It contains the state university, and was once the state capital. Pop. 10,000.

IOWA COLLEGE, the oldest collegiate institution in the state of Iowa, founded in 1846 by an association of congregationalists and presbyterians at Davenport, and incorporated in the following year. The college was opened in 1848, and in 1859 it was removed to its present situation in Grinnell. The institution includes three departments, the college, the academy, and the school of music, since 1857 open to both sexes. In 1895 the collegiate courses were arranged on the group system, and lead to the degrees of B.A. and B.Ph.

IOWA STATE COLLEGE OF AGRICULTURE AND MECHANIC ARTS, a co-educational institution at Ames, Iowa, established in 1858. In 1862 a grant of public lands was bestowed on the college by a general act of congress for the purpose of fostering agricultural and mechanic education. It is a college of advanced technology, and organized in divisions of agriculture, engineering, veterinary medicine and science A well stocked farm provides practical work and the Iowa experiment station gives opportunity for original investigations of agricultural problems. Tuition is free to residents of Iowa, those from other states paying an annual fee of $24 00

IPECACUAN'HA, a substance used in medicine, of a nauseous odor and repulsive bitterish taste, the dried root of several plants growing in South America. All the kinds have nearly the same in-

Ipecacuanha plant.

gredients, but differ in the amount of the active principle which they contain. The best is the annulated, yielded by a small shrubby plant, a native of Brazil, Colombia, and other parts of South America. When given in very small doses ipecacuanha improves the appetite and digestive powers; in a somewhat larger dose it may be given to increase the secretion from the mucous membrane of the air-passages; and in a still larger, from 15 to 20 grains, it occasions vomiting. It is also capable, by being combined with other substances, of producing increased perspiration, as in the well-known Dover's powder.

IPHIGENIA (if-i-je-nī'a), in Greek legend and poetry, daughter of Agamemnon and Clytemnestra. To avert the wrath of Artĕmis, whom Agamemnon had enraged by killing a consecrated hind, and who detained the Greek fleet at Aulis that had been prepared for the Trojan war, Iphigenia was to be sacrificed on the altar; but a hart was miraculously substituted for her, and she was conveyed in a cloud to Tauris. She became priestess here to Artĕmis, and saved her brother Orestes when on the point of being sacrificed.

IPSWICH (ip'sich), a parl., county, and municipal borough and river-port in England, capital of Suffolk, on the Orwell. Pop. 66,622.

IQUIQUE (i-kē'kā), a seaport of Chile, province of Tarapaca, a considerable town with an important trade, its rise being due to the extensive deposits of nitrate of soda and borax, and the silver-mines, etc., in its neighborhood. It has suffered much from earthquakes, and in 1879 was blockaded, bombarded, and finally captured by Chile.

IRADE (i-rä'de), a decree or command of the sultan of Turkey, directed to the grand vizier, whose duty it is to promulgate it to the public.

IRAK AJ'EMI, an interior province of Persia, separated from the Caspian sea by Ghilan and Mazanderan; area, about 138,000 sq. miles, a large part of which in the east is occupied by salt deserts, the rest being largely mountainous, with some valleys and rich plains. The chief towns are the capital, Teheran, and Ispahan.

IRELAND (in Irish, Erin; in Latin, Hibernia), the more western and smaller of the two principal islands of which the United Kingdom is composed, is separated from Great Britain on the east by the Irish sea, and surrounded on all

IRELAND

SCALE OF MILES
0 5 10 20 30 40 50

10° Longitude west from Greenwich 0°

ATLANTIC OCEAN
IRISH SEA
ST. GEORGES CHANNEL
NORTH CHANNEL
SHARK'S HEAVEN
BROAD HAVEN
DONEGAL BAY
GALWAY BAY
DINGLE BAY
KILLALA BAY
SLIGO BAY
DUNDALK BAY
DUNDRUM BAY
BELFAST LOUGH
LOUGH FOYLE
LOUGH NEAGH
LOUGH ERNE
LOUGH DERG
LOUGH CORRIB
LOUGH MASK
LOUGH ALLEN
LOUGH GARA
LOUGH RIDIN
LOUGH SWILLY
LOUGH LARNE
LOUGH BELTRA
LOUGH GILL
LOUGH ARROW
LOUGH GARTAN
LOUGH MELVIN
LOUGH GOWNA
LOUGH SHEELIN
LOUGH RAMOR
LOUGH DERRAVARAGH
LOUGH OWEL
LOUGH RYNN
LOUGH REE
LOUGH DERG
LOUGH CURRANE
LOUGH LEE
LOUGH HYNE
LOUGH ENNELL
LOUGH ENNELL
LOUGH ENNELL

other sides by the North Atlantic ocean. The area is 32,551 sq. miles. Ireland is divided into the four provinces of Leinster, Ulster, Munster, and Connaught, and into 32 counties.

The population in 1841 was 8,175,124; in 1851, 6,552,385, the decrease being partly owing to the famine resulting from the potato disease in 1846–47, and partly to emigration. Since 1851 over 3,800,000 emigrants have left the country. Pop. in 1891, 4,704,750; in 1901, 4,458,775. The capital is Dublin; the other chief towns are Belfast, Cork, Limerick, and Londonderry.

The coast, forming a line of nearly 3000 miles, is, in general, bold and rugged, and is diversified by numerous indentations, some of which run far into the land and form excellent natural harbors. There are a considerable number of islands, chiefly on the west coast, the largest being Achill. The mountains, generally speaking, rise in isolated masses at a short distance from the coast, the interior having the form of a vast plain, in which are extensive tracts of bog. Rivers are not only numerous but are very equally distributed over the surface. The Shannon, in the west, the largest river of Ireland if not of the United Kingdom, is navigable to its source in Lough Allen, forming a waterway of 240 miles. The other rivers of most importance are the Bandon, Lee, Blackwater, Suir, and Barrow, which enter the sea on the south, the last two by the union of their streams forming the broad estuary of Waterford harbor; the Slaney, in the southeast angle, which expands into Wexford Haven; the Liffey and the Boyne, entering the sea on the east, the former having the capital at its mouth, the latter being the largest river which discharges itself into the Irish sea on the east coast; and the Bann and the Foyle, which have their mouths at no great distance from each other on the north coast. Ireland possesses a vast number of lakes, among which the lakes of Killarney, in the southwest, are pre-eminent for beauty, and attract numerous visitors.

Granite, coal, iron, lead ore, slate, alum, salt, etc., are found.

The climate is on the whole moist, mild, and equable. It is highly favorable to vegetation and allows plants to winter in the open air; some species of plants also being peculiar in Ireland alone of the British isles, as for instance the strawberry-tree or arbutus, found in the southwest.

As regards agriculture Ireland has great advantages, for though there is a great extent of moorland, there is also a vast area of arable surface, covered with a deep friable loam of remarkable richness. The rearing of live stock and dairy-farming are largely carried on. By far the largest grain crop is oats; the chief green crop is potatoes. Another staple crop, especially in the north, is flax.

Of industrial employments the linen manufacture is the chief. It has increased in a remarkable manner, and Belfast, its center, has become the second city of Ireland. The brewing of porter and distillation of whisky form important industries. The fisheries employ a considerable number of persons, but far fewer than they should. The salmon fisheries are valuable, and are increasing in value. The trade is only of a moderate bulk. The railway system has attained a total length of 3044 miles.

The prevailing religion is the Roman Catholic. The reformation never made much progress, and though the Protestant Episcopal Church was established by law it was only the church of a small minority. In 1869 an act was passed for its disestablishment. At the head of the Roman Catholic Church are four archbishops and twenty-four bishops. The whole of the Irish Roman Catholic clergy are supported solely by voluntary contributions. The number of priests is 3200, more than half being curates. There are numerous monasteries and convents. The Presbyterian Church is chiefly confined to Ulster, where it may be said, especially in the counties of Down and Antrim, to be the leading religious denomination. Its ministers are supported by voluntary contributions, seat-rents, and church funds. According to the census of 1901 there were in Ireland 3,308,661 Roman Catholics, 581,089 Episcopalians, 443,276 Presbyterians, 62,006 Methodists, and 63,743 members of other persuasions.

The principal educational institutions are Dublin university and the three Queen's colleges of Belfast, Cork and Galway. The Royal college of science, established in 1867, supplies a complete course of instruction in science applicable to the industrial arts. The Catholic University of Ireland, established in 1854, consists of University college, Dublin, St. Patrick's college, Maynooth, and several other colleges. The seminaries for the education of the Catholic priesthood are numerous, the most prominent being the College of Maynooth, founded in 1795. The General Assembly's theological college, Belfast, and the Magee college, Londonderry, are Presbyterian colleges. The chief elementary schools are those under the superintendence of the commissioners of national education, the majority of them now being free.

Ireland, by the act of union, became in 1801 an integral part of the United Kingdom, and shares in its legislation by means of twenty-eight representative peers in the House of Lords, and 103 representatives in the House of Commons. The representative peers are elected for life by the whole body of Irish peers. The lord-lieutenant, who represents the sovereign, is the head of the executive, and holds his court in Dublin castle. He is assisted by a privy-council and a chief-secretary, who takes the most active part in the administration of affairs.

The beginning of the history of Ireland is enveloped in fable. As in western Europe generally, the earliest inhabitants are believed to have been of Iberian race, and, therefore, akin to the modern Basques. They were followed by the Celts, different tribes of whom probably arrived at different times, giving rise to such names as Firbolgs, Milesians, etc. Among these the Scots were the latest, and latterly got the upper hand, so that their name became generally applied to all the inhabitants. There is no evidence that the Irish had the use of letters before the middle of the 5th century, when Christianity and Christian literature were introduced by St. Patrick. Subsequently Ireland became the seat of western learning; and its monasteries were the schools whence missionaries proceeded throughout continental Europe. Its internal condition, however, was far from satisfactory. Divided among a number of hostile kings or chiefs, it had been long torn by internal wars, and for nearly two centuries ravaged by the Danes, numbers of whom settled in the country, when, in the beginning of the 11th century, Brian Boroimhé united the greater part of the island under his scepter, restored tranquility, and subdued the northern invaders.

After the death of Brian at the close of the battle of Clontarf, 1014, gained against the Danes and their Irish allies, the island relapsed into its former state of division and anarchy. In this state of matters Henry II. of England obtained a papal bull giving him the right to subdue it. In 1172 Henry entered Ireland himself, and the clergy and the great princes acknowledged his supremacy. In 1315 Edward Bruce, brother of the Scotch king, landed at the head of a large force, and was crowned king, but was defeated by the English in 1317 near Dundalk. At the beginning of the 16th century the greater part of the island still remained unconquered by the English. The native Irish lived according to their old customs under their own chiefs, and in manners and mode of life still totally uncivilized.

In 1641 there began an attempt to shake off the English yoke, in which great atrocities were perpetrated on both sides. In 1649 Cromwell was appointed lieutenant, and energetically, but cruelly, reduced the whole country within nine months. The next struggle was that which followed the revolution, when James II. landed in 1689, and hoped to regain his crown by French and Irish aid. In the following year (1690) William III. arrived, and on the 1st of July gained a decisive victory over the forces of James on the Boyne, near Drogheda. In 1691 another victory was gained over the Irish at Aughrim in Galway, and in October Limerick, the last place that held out for James, capitulated.

The French revolution had a great effect on the minds of the Irish people, and it was partly through this influence that the Society of United Irishmen was formed, and that rebellion broke out in 1798. Great atrocities were perpetrated, but the rising was speedily crushed

The British government now resolved to unite the Irish and English parliaments, and an act providing for the legislative union of the two countries passed the Irish parliament in May, 1800, and the British parliament in July of the same year, in virtue of which the union was effected on the 1st of January, 1801. In 1829, mainly through the efforts of O'Connell, the Catholic emancipation act was passed under which Catholics could take a seat in

parliament, and were admitted to most public offices. (See Catholic Emancipation.) The Irish national party now tried to repeal the union, for which purpose O'Connell founded the repeal association. This movement collapsed in 1843, and afterward the potato famine in 1845, and again in 1846, cast all other interests into the background. To mitigate this calamity parliament granted enormous sums of money, yet thousands died from starvation, and hundreds of thousands emigrated to America.

The year 1865 witnessed a new conspiracy designed to separate England and Ireland. This originated in the United States, when the numerous Irish during the civil war in that country hoped for a rupture between it and England, of which they might take advantage. This conspiracy, the members of which called themselves Fenians (see Fenians), soon spread to Ireland; but before they could take any overt action in that island their design was stifled by the British government (1865–66). The ministry resolved to render the Irish people loyal and contented; and accordingly the Irish Episcopal Church was disestablished in 1869, and another act was passed to improve the tenure of land, in 1870.

Since 1871 an agitation for what is called home rule has made itself prominent. Its chief supporters, designated "nationalists," profess not to desire the severance of Ireland from Britain; what they mainly want, is to have an Irish parliament for matters exclusively Irish. In 1880 Ireland became the scene of an agitation carried on mainly by a body known as the land league. The movement was so lawless that two special acts, a "coercion" act and a peace preservation act, were passed. Still further to redress Irish grievances a land act was also passed in 1881, the chief provisions of which have already been mentioned. The land league was suppressed, but a body called the national league was soon organized in its place. In 1885, 86 nationalist members (under the leadership of Mr. Parnell) were returned to parliament, and their pressure on the government led to Mr. Gladstone's scheme in 1886 by which Ireland was to receive a parliament of her own and the Irish members to be withdrawn from the imperial parliament. This and the accompanying scheme for the buying out of Irish landlords were rejected by parliament and the majority of the constituencies, thus bringing a conservative government under Lord Salisbury into power. A permanent act for the repression of crime was passed in 1887, and an act (Lord Ashbourne's) for the benefit of Irish tenants. A home rule bill passed the Commons but not the Lords in 1893. The local government act of 1898 established local councils similar to those in Great Britain. The land purchase act of 1903 is intended to put an end to dual ownership, by enabling tenants to buy their farms.

The Irish language belongs to the Gaelic or Gaedhelic branch of the Celtic stem of languages, being closely akin to the Gaelic of Scotland and the Manx, and more remotely allied to the British dialects (Welsh, Cornish, and Armoric). The modern dialects or varieties of Irish, which differ very much from the ancient, are spoken by the rural classes in Connaught and Munster, and parts of Ulster. Gaelic is a comparatively modern form of Irish, which, both linguistically and from the extent and antiquity of its literature, is far more important than Gaelic.

Irish literature is rather varied and extensive, including history, legendary and actual, in prose and verse, annals, genealogies, and pedigrees, mythological and imaginative tales, lyric poetry, satire, lives of saints, treatises on law, science, grammar, etc. Some of these may be as old as the 5th century of our era.

IRELAND, John, an American Roman Catholic prelate, archbishop of St. Paul. He is a native of County Kilkenny, Ireland, and was born Sept. 11, 1838. At eleven years of age he settled at

Archbishop John Ireland.

St. Paul with his parents, was educated in France, and entered the priesthood in 1861. Having served as chaplain during the civil war Dr. Ireland became coadjutor of St. Paul in 1875, was made bishop in 1884 and archbishop in 1888. He has been prominent as a liberal Roman Catholic, has interested himself in national politics as a republican and has been several times mentioned as a candidate for cardinal.

IRETON, Henry, a parliamentary general, was born in Nottinghamshire in 1610. When the civil contest commenced he joined the parliamentary army, and by the interest of Cromwell, whose daughter Bridget he married in 1646, he became commissary-general. He commanded the left wing at Naseby, which was defeated. He was an implacable enemy of the king, had a principal hand in framing the ordinance for his trial, and sat himself as one of the judges. Ireton accompanied Cromwell to Ireland in 1649, and was left by him as lord-deputy. He deduced the natives to obedience with great vigor, but cruelly. He died of the plague before the walls of Limerick, 1651, and was buried in Westminster Abbey 1652.

IRIDIUM, a metal of a whitish color, not malleable, discovered in the black scales which remain when native platinum is dissolved in aqua regia; specific gravity about 22.4, symbol Ir. It takes its name from the variety of colors it exhibits while dissolving in hydrochloric acid. It is the most infusible of metals. It forms a number of alloys, one of which, iridosmine, occurs native. The alloy with gold is malleable and much resembles gold in appearance, that with copper is very hard, pale red in color, and ductile.

I'RIS, in Greek mythology, the fleet, golden-winged messenger of the Olympian gods. Iris was originally the personification of the rainbow, though she does not appear as such in the Homeric poems. She is represented with wings attached to her shoulders and a herald's staff in her left hand, representative of her office of messenger.

IRIS, the muscular curtain stretched vertically in the anterior part of the eye, perforated by and forming the colored circle around the pupil.

IRIS, a plant that gives name to the natural order Iridaceæ, and is also called flag and fleur-de-lis. The plants of the genus Iris, some of which are medicinal and others merely ornamental, are found in many localities over Europe, Asia, and America. They usually grow in wet places, bearing flowers of various colors, but the prevailing tint is blue. Orris-root consists of the root-stock of some species, as I. florentina; and the root-stock of this and other species are cathartic or emetic.

IRISH SEA, the sea between Great Britain and Ireland, north of St. George's channel and south of the North channel, 130 miles long and about 60 miles wide. It contains the islands of Anglesey and Man.

IRI'TIS, inflammation of the iris of the eye. The symptoms of iritis are a zone of a pale pink color round the cornea, formed by vessels traversing the sclerotic; and the iris itself undergoes a remarkable change of color. The patient experiences pain in the orbit of the eye, in the forehead, and side of the head, which frequently grows more intense at night. Iritis may arise from wounds in the iris, from too prolonged continuous use of the eye, or from constitutional predisposition induced by syphilis, scrofula, etc. It may be treated according to circumstances by blood-letting, belladonna, and mercury.

IRKUTSK', a town in Southern Siberia, capital of government of same name, at the junction of the Irkut with the Angara, about 40 miles from Lake Baikal. Pop. 51,434.—The government has an area of 309,190 sq. miles, and a pop. of 540,535.

IRON, the most universally distributed and the most generally applied of all the metals. It is the most tenacious of the metals, having a breaking strain of 106,000 lbs. per sq. inch of section; and two pieces can be perfectly welded together when raised to a

white heat. It is so ductile that it can be drawn into wire as fine as the human hair. It occurs chiefly in the earth's crust in combination with oxygen, but it is also found in combination with several other elements, and sometimes, although rarely, native or in the metallic state.

It is from one or other of its ores that the iron of commerce is obtained. The ores of iron are very numerous, but the oxides, carbonates, and sulphides are the most important.

Before the ores pass into the smelter's hands they are subjected to the preliminary process of calcination or roasting. The object of this operation is to separate water, carbonic acid, sulphur, and other volatilizable substances from the ore, and at the same time to render the ore more porous. This is now generally effected by placing the ironstone over a coal-fire at the bottom of a kiln; when the ore is red-hot a fresh layer, 8 or 9 inches in depth and mixed with coal, is added, and so on until the kiln is filled. When the bottom layer is cold it can be withdrawn, and the process thus becomes continuous.

The smelting of the iron is the next process, that is, the production of the metallic iron from the ore. Until the beginning of the 17th century charcoal was exclusively used for iron-smelting, but coal and coke have now taken its place, except in those countries where forests still abound and charcoal can be procured readily and cheaply. Chief among iron-smelting appliances is the blast-furnace, and the great progress made in the production of pig-iron is largely due to better constructed furnaces.

To obtain malleable or wrought iron, it is necessary to free the pig-iron from the sulphur, phosphorus, silicon, and excess of carbon it contains, as these substances lessen the tenacity of the iron, and render it unfit for rolling into bars or plates. But a small quantity of carbon (under 1 per cent) is essential to the formation of good malleable iron; perfectly pure iron would be too soft.

By the Siemens regenerative and other similarly constructed furnaces, malleable iron and steel are now prepared directly from the ore. In recent years "malleable castings" have been introduced.

If iron is heated frequently or carelessly, it ceases to be fibrous and loses its tenacity; it is then said to be burnt. To restore it to its original condition, a fresh and very careful forging is generally needed. This may also be done by heating the piece of iron to bright redness, and plunging it into a boiling saturated solution of sea-salt until it is of the same temperature, about 230° Fahr. After this operation the metal can be easily doubled in the cold.

It is not always easy to draw the line between iron and steel, and many varieties of metal come into the market under the name of steel which in reality are alloys of iron with other metals, such as wolfram, manganese, chrome, etc. It is admitted by all metallurgists that one of the characteristics of true steel is that it hardens when heated and then suddenly cooled in water; but wolfram steel, for instance, exhibits the very opposite property. Experienced workmen can distinguish iron from steel by the musical note emitted on striking. A more certain method consists in treating the metal with diluted nitric or sulphuric acid. If the surface remains unaltered, or nearly so, when touched with a drop of either acid, the metal is iron; in the case of steel a black mark will be left, owing to the liberation of carbon.

Pure iron is a silver white metal, with a strong lustre, very tenacious, capable of receiving a high polish, and so soft as to be easily cut with a knife. It may be obtained by heating nitride of iron in a stream of hydrogen, or by electrolytic precipitation; but, according to Matthiessen, however metallic iron is obtained it always contains a trace of sulphur. In its chemical analogies iron is closely related to the metals cobalt, nickel, and chromium; it belongs to the hexad group of metals, and forms a large series of salts. The atomic weight of iron is 55.9 or 56. Iron dissolves slowly in dilute nitric acid; if not diluted, this acid rapidly oxidizes it. Dilute sulphuric acid dissolves this metal easily, but if concentrated, it has no action in the cold, whereas, on heating to ebullition, the iron is dissolved with evolution of sulphurous acid gas. Iron is also dissolved in hydrochloric acid and in aqua regia.

IRON-BARK, an Australian tree growing to the height of 100–150 feet, with heavy, strong, and durable timber, difficult to work and apt to be "shaky."

IRON-CLADS, see Navy.

IRON-CLAD VESSELS, or **ARMOR-CLAD-VESSELS,** a term applied in England to all vessels protected from the fire of heavy guns by thick plates of iron or steel, usually backed by wood. The iron-clad is comparatively a modern invention, and it was not until 1859 that Britain began to introduce such vessels

A, Iron plating. B, Teak backing. C, Ship's side.

into her navy; but since that time greater changes have taken place in the construction of war-ships than in all previous ages. Before the 19th century we have no record of vessels being fortified with iron plates, and the idea was first practically applied to some floating batteries by the French in the Crimean war. The improved shells played such havoc in the crowded 'tween decks of the line-of-battle ships then in use, that some extra protection became absolutely necessary. The first iron-clad, La Gloire, was constructed by the French in 1858, a wooden ship sheathed from end to end in 4½-in. iron plates, an armor then considered invulnerable. It was evident that Britain must not only take up the idea of the French, but also improve upon it, and this led to a period of unexampled activity in the naval yards of both countries. No sooner had France launched an iron-clad than Britain replied with another, although the former managed to keep the lead for some years. The first British iron-clad, the Warrior, was launched in the Thames in December, 1860, an iron frigate with air-tight compartments, 4½-in. iron armor and 18-in. wood backing, the two ends of the vessel unprotected. The French continued to build their vessels of wood for some years, while the British started at once with iron, which gave the advantage of extra lightness for the same strength Iron-clads may be divided into the three chief classes of broadside, turret, and barbette vessels. La Gloire and the Warrior carried their guns on the broadside like old wooden frigates, but as the number of guns carried was reduced as ordnance grew heavier, and all-round firing was found expedient, it was deemed necessary to limit the masses of armor by applying it to the most vulnerable parts only, and adopting various methods for attaining all-round firing. This brought about an entire new departure in ship-building—the construction of turret ships, or ships having a revolving covered turret or turrets rising above the deck and containing the chief guns, the turrets being of great strength, and having openings for the muzzles of the guns. The turret-ship is the invention of Ericsson in 1861–64 for the United States navy, and the advantages of his system were fully demonstrated in the successful conflict of the turret-ship Monitor with the broadside-ship Merrimac, in the American civil war. Ships on the barbette system have open towers or turrets rising above the deck, containing heavy guns which fire over the edge of the turrets (thus giving an extensive range). The manner in which the armor is distributed varies greatly in different ships. Battleships are of the first, second, or third class, according to their value as fighting-ships, which is gauged by the extent and resisting powers of their armor, the number, range, and penetrating power of their guns, their maximum speed and radius of action. It generally follows that the size of the ship is greatest in the first class and least in the third class.

IRON MASK, The man with the, unknown personage kept in various French prisons, who for a long time excited much curiosity. All that is known of him is that he was above middle height, of a fine and noble figure, and delicate brownish skin; that he had a pleasant voice was well educated, and fond of reading and guitar playing, and that he died in the Bastile 1703. The mask he wore seems to have been of black velvet, not iron. Conjecture has given him many names. He was stated to be in turn the Count of Vermandois (a natural son of Louis XIV. and de la Vallière), the Duke of Beaufort, the Duke of Monmouth, the son of Anne of Austria (mother of Louis XIV.) by some favorite, and twin-brother of Louis XIV.

but all these assertions have been unable to stand the test of thorough investigation. What seems most probable is that he was Count Birolamo Matthioli, first minister of the Duke of Mantua, who had betrayed the interests of Louis XIV. by failing to secure for him, as he had pledged himself to do, in consideration of a large bribe, possession of the fortress of Cassale, which gave access to the whole of Lombardy. For this offense the court of Versailles lured him to the French frontier, secretly arrested and imprisoned him in the fortress of Pignerolo. The secret was preserved so carefully, on the supposition that Matthioli was the ill-fated prisoner, because his seizure and detention were flagrant violations of international law.

IRON MOUNTAIN, capital of Dickinson co., Mich., on the Menoninee river and the Chi. and N. W. and the Chi., Mil. and St. P. railways; 208 miles n. of Milwaukee, Wis. It has large iron-mining interests; pop. 11,140.

IRON MOUNTAIN, or **IRON MOUNT,** a famous iron mountain in St. François co., Mo.; 81 miles s.w of St. Louis. It is 228 feet high, covers 500 acres, is of mammillary shape, and consists chiefly of an iron ore which yields 55 or 60 per cent of excellent iron. The amount of ore in Iron Mountain seems to be immense, the main body having a thickness of 50 feet, and continuing indefinitely in depth.

IRONTON, capital of Lawrence co., Ohio, on the Ohio river, and the Cin., Day. and Iron., the Iron, and the Norfolk and West. railways; 50 miles s.w. of Pomeroy; 145 miles s. by e. of Cincinnati. It is in an iron and bituminous coal region. The principal manufactures are machinery, boilers, foundry products, rolled iron, nails, stoves, firebrick, and furniture Pop. 13,255.

IRONWOOD, a city in Gogebic co., Mich., on the Mil., Lake S. and W. and the Wis. Cent. railways; 39 miles e. by s. of Ashland, Wis., 150 miles w. of Marquette. It is in the celebrated Gogebic iron-mining region, and has four newspapers Pop. 11,750.

IRON-WOOD, a name given to various trees from the quality of their timber The iron-wood or hop-hornbeam of America, is a tree with a trunk not

Iron-wood.

exceeding 6 in. in diameter, with very hard wood, so heavy that it sinks in water, and foliage resembling that of birch.

I'RONY, a form of speech in which the meaning intended to be conveyed is contrary to the natural meaning of the words. Irony, as a rhetorical device, becomes a most effective weapon for ridiculing an antagonist.

IROQUOIS (i'ro-kwą), the joint name given by the French to a once powerful confederacy of six North American Indian tribes (Mohawks, Oneidas, Senecas, etc.). They formerly resided on the Mohawk river, and extended their conquests to the Mississippi, and beyond the St. Lawrence. It is probable that but for the settlement of the whites they would have secured dominion from Canada to the Gulf of Mexico. Some of the tribes are now extinct; some have made considerable advances in civilization, while others have fallen into a state of squalid misery. Part of the Canadian Indians are Iroquois.

IRRADIATION, that effect on the eye through which brilliantly illuminated white surfaces and self-luminous bodies, when emitting white light, appear to the eye much larger than they really are.

IRRAWAD'DY, Irawadi, a large river traversing Lower and Upper Burmah from north to south, falling into the Indian ocean by various mouths and forming a great delta.

IRRIGATION, the art of increasing the productiveness of soils by the artificial supply of water to them. This is as old as agriculture, and references to it exist in very early records, especially in Egypt, India, and China. In countries with very small rainfall, and subject to droughts, agriculture without irrigation would be uncertain and unprofitable. For this reason the British government has promoted extensive irrigation works in India, and, although financially a loss, they are a great boon to the agricultural population, and do much to mitigate those famines which have been so common among them. In Sind 80 per cent of the cultivated area is irrigated, in the United (n.w.) provinces 32 per cent. The greatest irrigation-work is the Ganges canal, 445 miles long. In the south of Europe, particularly in Italy and Spain, irrigation works of a high order have existed from ancient times, and it is supposed that the Romans introduced similar works into Britain, where it is extensively practiced in some parts especially for the growing of grass. In California and elsewhere in the western states and territories of America it is largely employed for crops also, of various kinds. The water not only supplies the moisture so necessary to vegetation, but it fertilizes the soil by furnishing such mineral constituents as salts of potash and soda, sulphates of lime, soluble silica, etc., all of which act on the soil, especially if the water be rich in them, like a dressing of bone-manure. Sewage water is more valuable than pure water, from the large amount of putrificd animal and vegetable matter it carries, and the drainage of many towns finds thus profitable application. There are various systems of distributing the water in irrigation to suit the special requirements of different surfaces, positions, and uses of land.

IRVING, Sir Henry (originally John Henry Brodribb), a celebrated English actor, born in 1838. After playing for nearly three years in Edinburgh he appeared at the Princess' theater, London, in 1859. After a short stay here, and a few months in Glasgow, he went to Manchester, where he remained for five or six years. Having returned to London in 1866 he took part in the Belle's Stratagem, Hunted Down, Uncle Dick's Darling, etc.; but his first marked success was as Digby Grant in Albery's Two Roses (in 1870), which was followed by his powerful impersonation of Mathias in The Bells (founded on Erckmann-Chatrian's Polish Jew). His next noteworthy parts were Charles I., Eugene Aram, and Richelieu, in the plays so named. In 1874, at the Lyceum theater, he sustained the part of Hamlet so successfully as to raise himself to the first place among English actors. His chief Shakespearean parts subsequently played are Macbeth, Othello, and Richard III. In 1878 he leased the Lyceum theater for himself, and has since put on the stage in excellent style Othello, The Merchant of Venice, Much Ado About Nothing, Romeo and Juliet, Twelfth Night, Faust, Macbeth, etc., playing in them the principal character along with Miss Ellen Terry. His repeated visits to the United States have been very successful. He has contributed a few papers to the magazines on subjects connected with his art, and has delivered addresses at Oxford and Harvard universities. He was knighted in 1895. He died in 1905.

IRVING, Washington, one of the best American writers, born in New York 3d April, 1783; died 28th November, 1859, at Sunnyside, on the Hudson. In 1802 his Letters of Jonathan Oldstyle appeared in the New York Morning Chronicle. Shortly afterward, he sailed for Europe, visited most continental coun-

Washington Irving

tries, and did not return to America until March, 1806. His sketches of Dutch character, in his Knickerbocker's History of New York, which made its appearance in December, 1809, proved him possessed of quaint and genial humor to a high degree. In 1815 he visited England to follow literature as a profession, and settled in London. A series of papers entitled The Sketch Book, first published at New York, 1818, met with such success that an enlarged edition was published in London two years later. For seventeen years until 1832

Irving resided in Europe, principally in England, France, and Spain. This was a period of great literary activity, and brought forth some of his most famous works, such as Bracebridge Hall, The Tales of a Traveler, and The Life of Columbus, for which 5,000, 7,500, and 15,000 dollars respectively were paid him by the publishers. He also acted for a time as secretary to the American embassy in London, and the University of Oxford honored him in 1831 with the degree of D.C.L. Having returned to New York in the spring of 1832 he accompanied the expedition for the removal of the Indian tribes beyond the Mississippi, and collected the material for his Tour on the Prairies, published in 1835. From 1842 to 1846 he acted as United States ambassador at Madrid, and on his return in that year he retired to his country-seat at Sunnyside. His biography of Oliver Goldsmith, Mahommed and his Successors, and the Life of Washington (1855–56) occupied his last years. Other works of his are: The Conquest of Granada, Tales of the Alhambra, Legends of the Conquest of Spain, Voyages of the Companions of Columbus, Adventures of Captain Bonneville, and Astoria. His famous story of Rip van Winkle belongs to the Sketch Book.

IRWIN, May, American actress, born at Whitby, Ont., in 1862. As a star she appeared in The Widow Jones, The Belle of Bridgeport, Madge Smith, Attorney, and other light pieces.

ISAAC (Heb. "he will laugh"), one of the Hebrew patriarchs, the son of Abraham by Sarah, so called to denote the laughter and gladness occasioned by his birth. He is remarkable as the offspring of very old age, Sarah being ninety and Abraham a hundred years old at the time of his birth; for his miraculous escape from death as a burnt-offering; and for the fraud perpetrated upon him, at his wife Rebecca's instigation, by his son Jacob, to the injury of Esau. He died at Hebron 180 years old, and was buried in the cavern of Machpelah, the resting-place of Sarah and Abraham, and of Rebecca.

ISABELLA OF CASTILE, daughter of King John II. of Castile and Leon, consort of Ferdinand the Catholic, was born 1451, married 1469, and died 1504. She was a woman of great charms, courage, and sagacity, and contributed no small share to the many remarkable events of the reign of Ferdinand V., including the introduction of the inquisition, 1480, the discovery of America by Columbus, 1492, and the final expulsion of the Moors after the conquest of Granada.

ISABELLA II., ex-queen of Spain, daughter of Ferdinand III., was born in 1830, and succeeded her father three years after, her mother being appointed queen-regent. The early years of her reign were disturbed by a rising in favor of her uncle, Don Carlos, who, if the Salic law had not been set aside, would have ascended the throne instead of her; but this was finally quelled in 1839. She was declared of age in 1843, and in 1846 was married to her cousin, Don Francisco d'Assisi. Her reign was so despotic that a revolution took place in 1868, which drove her from the country. She resigned her claims to the crown in favor of her son Alfonso, who ascended the throne in 1875. She lives sometimes in Spain, sometimes in Paris.

ISAIAH, the first of the great Hebrew prophets. He began his predictions in the last years of Uzziah's reign. Of his father, Amoz, we know nothing, and of the circumstances of his life but little. We know, however, that he had great influence over the kings and people of Judah, and he is supposed to have died at a good old age at Jerusalem, at the beginning of Manasseh's reign. The first portion of the writings that pass under his name consists chiefly of declarations of sins and threatenings of judgments, while the last 27 chapters, together with some previous ones, hold out promises of a glorious future for Israel. The style throughout is clear and simple, yet dignified and sublime in the highest degree. His authorship of the last 27 chapters is denied by some eminent critics, who unite in ascribing them to a later prophet, perhaps also called Isaiah, while others believe that the name Isaiah stands for a school of prophets; but the integrity of the book has still many able defenders.

ISERE, a department of southeastern France; area, 3815 sq. miles. Grenoble is the capital. Pop. 568,693.

ISHMAEL, the son of Abraham by Hagar. He married an Egyptian wife, and had twelve sons and one daughter, who became the wife of Esau. He died when 137 years old. It was predicted that he was to become "a great nation," and the Arabs, especially the Bedouins, are often regarded as descendants of Ishmael.

ISHMAELITES, ISMAELITES, or **ISMAELIENS,** a Mohammedan sect originating in the 1st century of the Hegira, and deriving its name from Ishmael or Ismael, one of Ali's descendants. From the 8th to the 12th century they were powerful in the east, made many conquests, and under various chiefs and names distributed themselves over Irak, Syria, Persia, and Egypt. A small remnant of them still dwell in Syria. The Assassins (which see) were a branch of this sect.

ISH'PEMING, a city in Marquette co., Mich., on the Chi. and N. W., and the Duluth, S. Shore and Atlantic railways, 15 miles w.s.w. of Marquette. It is the center of the great Lake Superior iron-ore region, and is on the Marquette range, the most productive of the four iron ranges. Pop. 15,460.

ISINGLASS, a gelatinous substance, of which the best kind is prepared from the swimming-bladder or sound of the sturgeon, dried and cut into fine shreds, while the American article is obtained from the same part in the cod, hake, etc. It is the basis of the Russian glue, which is preferred to all other kinds for strength. A test solution is also prepared from it, by means of which tannic acid may be distinguished and separated from gallic acid, the former giving it a yellowish-white precipitate. Isinglass boiled in milk forms a nutritious jelly, and a solution in water, with a very small proportion of some balsam, spread on black silk, is the court plaster of the shops. It is also used in fining sherries and other white wines, and in making mock-pearls, stiffening linens, silks, gauzes, etc. With brandy it forms a cement for porcelain and glass.

I'SIS, the principal goddess of the Egyptians, the sister and wife of Osiris, representing the moon, as Osiris did the sun. The Egyptians believed that Isis first taught them agriculture, and as the Greeks offered the first ears gathered to Ceres, so did the Egyptians to Isis. She is represented under various forms. In

Isis.

one representation she has the form of a woman, with the horns of a cow, as the cow was sacred to her. She is also known by the attributes of the lotus on her head, and the sistrum in her hand, a musical instrument which the Egyptians used in the worship of the gods. She is often accompanied by her infant son Horus. In one celebrated Egyptian statue she was shown with her face veiled. She was particularly worshiped in Memphis, but at a later period throughout all Egypt. From Egypt her worship passed over to Greece and Rome, and the abuses which it occasioned at Rome caused its frequent prohibition there. It was, however, repeatedly revived. The Romans never considered the worship, which was introduced among them by Sulla (B.C. 86), altogether reputable, and its attendant immorality was vigorously lashed in the satire of Juvenal.

ISLAM (is-läm), that is complete resignation and submission to the will of God, is the name given in Arabic to the religion originated by Mohammed. The fundamental doctrine of Islamism, and the only one it is necessary to profess to be a Moslem, is expressed in the common formula of faith: "There is no God but Allah, and Mohammed is his prophet," to which the Shiahs or Shiites, that is the majority of Persian and Indian Moslems, add "and Ali is the vicar of God." See Mohammedanism.

ISLAND, a portion of land entirely surrounded by water, and smaller in size than the great masses of land known as continents. Islands are of all sizes, from mere dots of land or rock in the sea to a great mass like Australia, which is often spoken of as a continent. Islands are divided into two distinct classes: continental islands, lying in proximity to continents, and pelagic or oceanic, from their position in the oceans. Continental islands occur along the margin of the continents, and are generally of the same geological structure. Pelagic islands are mostly of volcanic or coral formation. A cluster

of islands, such as the West Indies, the Canaries, the Hebrides, etc., are called an archipelago.

ISLE OF MAN. See Man.

ISLE OF PINES, an island lying south of the western portion of Cuba, to which it belongs, 40 miles by 34, with good pastures and valuable timber.

ISLE OF WIGHT. See Wight.

IS'LINGTON, a mun. and parl. borough in the north of London. Pop. 334,928.

ISMAELITES, a Mohammedan sect. See Ishmaelites.

ISOBAR'IC LINES, lines drawn on a map or globe through all places where the barometer is at the same height at a certain time. Telegraphic communication enables these lines to be drawn with some accuracy.

ISOCHEIMAL LINES. See Isothermal Lines.

ISOCH'RONISM, the property by which a pendulum, or a balance-wheel, or an oscillating particle (as of air) conveying sound vibrates through longer or shorter arcs in the same time (or nearly so). Given a certain length of spring, all the vibrations, large or small, are isochronous. If the spring is shortened the large vibrations take place quicker than the short ones; if, on the contrary, the spring is lengthened, the small arcs are performed quicker than the large ones. For small oscillations a pendulum is almost exactly isochronous, but it is only with the cycloidal pendulum that perfect isochronism is obtained.

ISOCLINIC LINES. See Isogonic Lines.

ISOGON'IC LINES, lines drawn on a map through all places where the declination of the magnetic needle is the same. Isoclinic lines are drawn through places where the inclination or dip of magnetic needle is the same; the zero isoclinic line drawn through places where there is no dip) is called the magnetic equator.

ISOTHER'MAL LINES, lines drawn on a map or globe through places which have the same mean annual temperature. (See Climate.) Isotheral lines are drawn through places having the same mean temperature during the hottest month of the year. Isocheimenal or isocheimal lines are drawn through places having the same mean temperature during the coldest month in the year.

ISPAHAN (is-pȧ-hän'), or **ISFAHAN,** a very ancient city of Persia, and for centuries its capital, in the province of Irak-Ajemi, on the river Zendarud, 210 miles south of Teheran, the present Persian capital. It was once one of the most important and magnificent cities in the east, but little is now left of its former splendor, the largest part of the city being in ruins. Much opium is grown in the neighborhood, as also tobacco, madder, etc., forming important articles of trade. Ispahan is the emporium of the inland commerce of Persia. Pop. 90,000.

ISRAEL and Israelites. See Jews.

ISSUE, in law, the point or matter depending in a suit on which two parties join and put their cause to trial. It is a single, definite, and material point issuing out of the allegations of the parties, and consisting regularly of an affirmative and negative. It is either an issue in law to be determined by the court, or in fact to be ascertained by a jury.

ISTAMBOL. See Constantinople

ISTAR, the ancient Babylonian goddess of war and love.

Mosque of Sultan Hussein, Ispahan.

ISTHMUS, in geography, a neck of land by which two continents are connected, or a peninsula is united to the mainland. Such as the Isthmus of Panama, connecting North and South America

IS'TRIA, a peninsula of triangular form, projecting into the northeast corner of the Adriatic sea, part of the Austro-Hungarian dominions, area 1900 sq. miles. Pop. 344,173.

ITALY, a kingdom in Southern Europe consisting in the main of a large peninsula, having a singular resemblance to a boot in shape, stretching southward into the Mediterranean, but also including a considerable portion of the mainland and the islands of Sicily, Sardinia, Elba, Ischia, Lipari Islands, etc. It is bounded on the north and northwest by the Alps, which separate it from Austria, Switzerland, and France, and on the northeast by Austria; elsewhere it is washed by the Mediterranean, or the Adriatic, an arm of the latter. The area is about 114,000 sq. miles. For administrative purposes it is divided into sixty-nine provinces, which are grouped under sixteen departments, some of them consisting of only a single province.

From 1861, when the kingdom of Italy was constituted until 1865, Turin was the capital, Florence was then selected, and in 1871 Rome. The largest town is Naples; next in order are Rome, Milan, Turin, Palermo, Genoa, Florence, Venice Italy now possesses Massowah and other territory on the east or Red Sea coast of Africa. Pop. 32,475,263.

Among the principal physical features of Italy are the Alps on its northern frontiers, and the chain of the Apennines which run down the middle of the peninsula through its whole length to the Straits of Messina, while numerous branches are thrown off laterally, and form an endless succession of wooded hills, olive-clad slopes, and fertile valleys. In the north, inclosed between the ranges of the Alps and Apennines, is a vast and fertile plain intersected by the Po and its tributaries. Two active volcanoes belong to the kingdom, Vesuvius in South Italy and Etnain Sicily. The only river of any magnitude is the Po, which has a length of about 45 miles before it enters the Adriatic. In the peninsular part of Italy are the Arno, Tiber, Garigliano, Volturno, etc. There are a number of lakes, of which the most important are Lake Maggiore, Lugano, Como, and Garda in the Alpine region; Lakes Trasimeno, Bolsena, and Albano in the Apennine region. Italy is rich in useful minerals, but the scarcity of coal prevents the full development of mining industry. Sulphur, salt, iron, and marble are the chief, though small quantities of lead, copper, zinc, silver, and borax are also obtained.

In the south of Italy the climate resembles that of Africa, being dry and burning and subject to the sirocco. In the northern regions, the neighborhood of the Alps, and the abundance of watercourses, serve to maintain a pleasant temperature. The Riviera or coast of the Gulf of Genoa is a favorite winter resort from more northern regions.

The natural productions of the soil of Italy are various. In the Alpine regions all plants belonging to temperate climate flourish, while the southern regions possess almost a tropical flora. Agriculture forms the chief support of the population, and the land, where not mountainous, is generally productive, although the system of culture adopted is in most parts defective, and large areas remain untilled. The best cultivation, aided by an excellent system of irrigation, is found in Lombardy, Venetia, Piedmont, Tuscany, and the parts of Emilia adjoining the Po. Most kinds of cereals, including wheat, rice and corn, are cultivated. Hemp, madder, flax, tobacco, hops, saffron, and in the extreme south, cotton and sugarcane are cultivated. Fruits are the object of attention everywhere; and in the cultivation of the olive in particular Italy surpasses all other European states. The fruits include oranges and lemons in the warm regions of the south, besides fig, peaches, apricots, almonds, etc. There is a very large production of wine, but only a few of the wines have any reputation in other countries. The rearing of livestock is an important industry. The cheese of Italy is famous, especially the Gorgonzola and the Parmesan.

Since the consolidation of the Italian kingdom, the manufactures of the country have made considerable advances. The most important of these are the silk manufactures, Italy as regards the production of raw silk being in advance of all the other countries of Europe. Lombardy, Piedmont, and Venetia are the great centers for its preparation. The cotton manufactures are centered in Upper Italy, chiefly in Lombardy. Woolen manufactures are chiefly carried on in Upper Italy. In the iron industry the department of Lombardy stands at the head; more particularly the provinces of Brescia, Como, and Milan. Tanning, the manufacture of linen, of paper, gold and silver wares, articles in bronze, musical instruments, the making of gloves, boots and shoes, felt and silk hats

ITALY

The States of the Church (disolved in 1860) were included in the section inclosed by a red line.

Scale of Miles
0 20 40 60 80 100

Railways thus

1. Torino A 2
2. Novara B 2
3. Como B 2
4. Sondrio B 2
5. Bergamo B 1
6. Brescia C 2
7. Verona C 2
8. Vicenza C 2
9. Belluno D 1
10. Udine D 1
11. Treviso D 2
12. Venezia D 2
13. Padua C 2
14. Rovigo C 2
15. Mantova C 2
16. Cremona B 2
17. Milano B 2
18. Pavia B 2
19. Alessandria B 2
20. Cuneo A 2
21. Porto Maurizio A 2
22. Genova B 2
23. Piacenza B 2
24. Parma C 3
25. Reggio C 2
26. Modena C 2
27. Bologna C 2
28. Ferrara C 2
29. Ravenna D 2
30. Forli D 2
31. Firenze C 3
32. Lucca C 3
33. Mass & Carrara C 2
34. Pisa C 3
35. Siena C 3
36. Arezzo C 3
37. Pesaro & Urbino D 3
38. Ancona D 3
39. Macerta D 3
40. Ascoli D 3
41. Perugia D 3
42. Grosseto C 3
43. Roma D 3
44. Abro. Ultre. II D 3
45. Abro. Ultre. I D 3
46. Abro. Citere E 3
47. Terra di Lavoro E 4
48. Benevento E 4
49. Capitanata E 4
50. Principato Ultre E 4
51. Naples E 4
52. Principato Citre E 4
53. Potenza F 4
54. Bari F 4
55. Terra d Otranto F 4
56. Cal. Citeriore F 5
57. Cal. Ultre II F 5
58. Cal. Ultre I F 5
59. Messina E 6
60. Palermo D 6
61. Trapani D 6
62. Girgenti D 6
63. Caltanisetta E 6
64. Catania E 6
65. Syracuse F 6
66. Cagliari B 5
67. Sassari B 4

SWITZERLAND
AUSTRIA
FRANCE
PIEDMONT
LOMBARDY
VENICE
EMILIA
TUSCANY
MARCHES
UMBRIA
ABRUZZO
MOLISE
CAMPANIA
BASILICATA
APULIA
CALABRIA
CORSICA
SARDINIA
ROME
Gulf of Venice
LIGURIAN SEA
TYRRHENIAN SEA
ADRIATIC SEA
MEDITERRANEAN SEA
IONIAN SEA
GULF OF TARANTO
Lipari Is.
Ponza Is.
Ischia
Capri I.
Elba
Sicily
Palermo
Messina
Catania
Syracuse
Trieste
Venice
Florence
Milan
Turin
Genoa
Naples
Leghorn (Livorno)
Mt. Blanc
Mt. Cenis
Mt. Viso
Mt. Rosa
Mt. Adamello
Mt. Etna
Mt. Vesuvius
Strait of Bonifacio
Gulf of Genoa
Gulf of Naples
Gulf of Salerno
Gulf of Manfredonia
Gulf of Cagliari
Gulf of Taranto
Riviera di Ponente
Riviera di Levante
Maritime Alps
Pennine Alps
Lepontine Alps
Rhætian Alps
Carnian Alps
Julian Alps
Apennines
Gulf of Venice
Mouths of the Po R.
Po R.
Adige R.
Arno R.
Tiber R.
Volturno R.
Garigliano R.
Ofanto R.
Crati R.
Lao R.
Salandra R.
Basento R.
Agri R.
Sinni R.
Pescara R.
Sangro R.
Biferno R.
Fortore R.
Trigno R.
Tronto R.
Metauro R.
Chienti R.
Ombrone R.
Albegna R.
Garda L.
Lake of Como
L. Maggiore
L. Iseo
L. Bolsena
L. Trasimeno
L. Fucino
L. Varano
L. di Lesina
Gulf of Trieste
Gulf of Quarnero
Gulf of Policastro
Gulf of Squillace
Gulf of Gioja
Gulf of S. Eufemia
Gulf of Castellamare
Gulf of Oristano
Gulf of Asinara
Gulf of Ajaccio
Gulf of Porto
Gulf of Sagona
Gulf of Valinco
Strait of Messina
Strait of Bonifacio
Longitude East from Greenwich

ITALY

are also considerable industries. The manufacture of tobacco is a state monopoly. Of special repute are the cameos and mosaics of Rome, Naples, and Florence; the filigree and coral work of Genoa; the plaited straw and the earthenware manufactures of Italy generally.

The foreign trade is mainly with France and Algeria, Great Britain, Austria, and Germany. The chief imports are wheat, raw cotton, and cotton manufactures, coal, iron, and machinery, wool, sugar, coffee; the chief exports, raw silk, olive-oil, wine, fruits, eggs, coral, hemp, marble, rice, sulphur. The principal ports are Genoa, Leghorn, Messina, Naples, Palermo, Venice, Brindisi, and Catania. The total length of railways opened for traffic in 1903, was 9960 miles; of telegraph-lines, 24,346 miles, nearly two-thirds of the whole belonging to the government.

The constitution of the Kingdom of Italy is a limited monarchy, based upon the fundamental statute granted by King Charles Albert to his Sardinian subjects March 4, 1848. The king, who is hereditary, exercises the power of legislation only in conjunction with a national parliament, consisting of two chambers. The first chamber is called the senate, and is composed of the princes of the blood, and an indefinite number of members appointed for life by the king. The second chamber is called the chamber of deputies, and consists of 508 members, who are elected by a majority of all the citizens above twenty-one years of age who are in the enjoyment of civil and political rights. Each province has the right of independent administration, and the executive power is intrusted to a provincial council. In each province the power of the state is represented by a prefect, who is supported by a council. The executive power of the state is exercised by the king through responsible ministers.

All men capable of bearing arms are under obligation of military service from their twenty-first to the end of their thirty-ninth year. The strength of the standing army on a war footing is in all 793,113. The mobile militia number 307,696, and the territorial militia 2,222,637, giving a grand total for the whole military service of 3,323,446 men. Including vessels afloat or building, the navy numbered 14 battle-ships, several of the newest being among the fastest and most powerful yet constructed anywhere.

The Roman Catholic is the state religion, but all other creeds are tolerated and adherents of all religions have equal municipal and political rights. The pope has his seat at Rome, and his palaces of the Vatican and the Lateran, and his villa of Castel Gandolfo, are not under the jurisdiction of the state. In 1861 the law annihilating ecclesiastical jurisdiction and the privileges of the clergy was extended to the whole of the kingdom, and in 1866 a bill was passed for the suppression (with certain exceptions) of religious houses throughout the kingdom. Elementary education is nominally compulsory, and is entirely supported from the municipal rates; but the number who can neither read nor write still remains very large. For secondary instruction there are a large number of gymnasia and technical schools, and for the higher education there are no less than twenty-one universities, many of them of ancient foundation, and at one time of considerable renown.

The ancient history of Italy will be found under Rome. The modern history begins with 476 A.D., when Odoacer, chief of the Herulians, a German tribe who had invaded the country, was proclaimed king of Italy. After a reign of twelve years he and his followers were overpowered by the Ostrogoths under Theodoric the Great. The Ostrogoths were in turn subdued by Byzantine troops, and Italy came under the dominion of the eastern emperors, who ruled through an exarch residing at Ravenna. In 568 the Lombards (Langobardi), a German people originally from the Elbe, led by their king, Alboin, conquered the Po basin, and founded a kingdom which had its capital at Pavia. The kingdom of the Lombards included Upper Italy, Tuscany, and Umbria, with some outlying districts. But on the northeast coast the inhabitants of the lagoons still retained their independence, and in 697 elected their first doge, and founded the republic of Venice. (See Venice.) Ravenna, the seat of the exarch, with Romagna, Rimini, Ancona, and other maritime cities on the Adriatic and almost all the coasts of Lower Italy, remained unconquered, together with Sicily and Rome. The slight dependence of this part of Italy on the court of Byzantium disappeared almost entirely in the beginning of the 8th century. The power of the pope, though at first recognized only as a kind of paternal authority of the bishop, grew steadily in these troubled times, especially in the struggle against the Lombard kings. In consideration of the aid expected against King Astolphus, Pope Stephen III. (754) not only anointed the king of the Franks, Pepin, but appointed him patrician or governor of Rome. In return Pepin presented the exarchate of Ravenna, with the five maritime cities, to the pope, thus laying the foundation of the temporal power of the holy see. At the invitation of Pope Hadrian I. Charlemagne made war upon Desiderius, the king of the Lombards, took him prisoner in his capital, Pavia (774), and united his empire with the Frankisk monarchy. Italy, was the exception of the Duchy of Benevento and the republics of Lower Italy, thus became a constituent of part the Frankish monarchy, and the imperial crown of the west was bestowed on Charlemagne (800). On the breaking up of the Carlovingian empire Italy became a separate kingdom, and the scene of strife between Teutonic invaders. At length Otto the Great was crowned emperor at Rome (961), and the year after became emperor of what was henceforth known as the Holy Roman Empire.

During the following centuries the towns and districts of North and Middle Italy gradually made themselves independent of the empire, and either formed themselves into separate republics or fell under the power of princes bearing various titles. A large part of Middle Italy at the same time was under the dominion of the popes, including the territory granted by Pepin, which was afterward enlarged on several occasions. In South Italy there were in the time of Charlemagne several independent states. In the 9th century this part of the peninsula, as well as Sicily, was overrun by Saracens, and in the 11th century by Normans, who ultimately founded a kingdom which embraced both Lower Italy and Sicily, and which, though it more than once changed masters, continued to exist as an undivided kingdom till 1282. In that year Sicily freed herself from the oppression of the then rulers, the French, by the aid of Pedro of Aragon (see Sicilian Vespers), and remained separate till 1435. It was again separate from 1458 to 1504, when both divisions were united with the crown of Spain. With Spain the kingdom remained till 1713, when Naples and Sicily were divided by the Treaty of Utrecht, the former being given to Austria, the latter to the Duke of Savoy. In 1720 they were again united under Austria, but in 1734 were conquered from Austria and passed under the dominion of a separate dynasty belonging to the Spanish house of Bourbon. See Sicilies, Kingdom of the Two.

The history of mediæval Italy is much taken up with the party quarrels of the Guelfs and Ghibellines, and the quarrels and rivalries of the free republics of Middle and Upper Italy. In Tuscany the party of the Guelfs formed themselves into a league for the maintenance of the national freedom under the leadership of Florence: only Pisa and Arezzo remained attached to the Ghibelline cause. In Lombardy it was different. Milan, Novara, Lodi, Vercelli, Asti, and Cremona formed a Guelf confederacy, while the Ghibelline league comprised Verona, Mantua, Treviso, Parma, Placenza, Reggio, Modena, and Brescia. Commercial rivalry impelled the maritime republics to mutual wars. At Meloria the Genoese annihilated (1284) the navy of the Pisans, and completed their dominion of the sea by a victory over the Venetians at Curzola. (1298). See Popes, Genoa, Florence, etc.

Up till the time of the Napoleonic wars Italy remained subject to foreign domination, or split up into separate republics and principalities. The different states were bandied to and fro by the chances and intrigues of war and diplomacy between Austria, Spain, and the House of Savoy. During the career of Napoleon numerous changes took place in the map of Italy, and according to an act of the congress of Vienna in 1815 the country was parceled out among the following states:—(1) The Kingdom of Sardinia, consisting of the island of Sardinia, Savoy, and Piedmont, to which the Genoese territory was now added. (2) Austria, which received the provinces of Lombardy and Venetia, these having already been acquired by her either before or during the time of Napoleon. (3) The Duchy of Modena. (4) The Duchy of Parma. (5) The Grand-duchy of Tuscany. (6) The Duchy of Lucca. (7) The States of the Church. (8) The Kingdom of the Two

Sicilies. (9) The Republic of San Marino (10) The Principality of Monaco. The desire for union and independence had long existed in the hearts of the Italian people, and the governments at Naples, Rome, Lombardy, and other centers of tyranny were in continual conflict with secret political societies. The leading spirit in these agitations in the second quarter of the 19th century was Giuseppe Mazzini, who in the end contributed much to the liberation of his country. The French revolution of 1848 brought a crisis. The population of Lombardy, Venetia, Parma, and Modena took up arms and drove the Austrian troops in retreat to Verona. Charles Albert, King of Sardinia, then declared war against Austria, and was at first successful, but his forces were sevcrely dcfeated at Novara (March, 1849), when Charles Albert abdicated in favor of his son Victor Emmanuel. Meanwhile the pope had been driven from Rome, and a Roman republic had been established under Mazzini and Garibaldi, the leader of the volunteer bands of Italian patriots. Rome was, however, captured by the French, who came to the aid of the pope (July, 1849), who resumed his power in April, 1850, under the protection of the French, and the old absolutism was restored. Similar attempts at revolution in Sicily and Naples were also crushed, but the secret societies of the patriots continued their operations. In 1859, after the war of the French and Sardinians against Austria, the latter power was compelled to cede Lombardy to Sardinia, and in the same year Romagna, Modena, Parma, and Piacenza were annexed to that kingdom, which was, however, obliged to cede the provinces of Savoy and Nice to France. In the south the Sicilians revolted, and supported by a thousand volunteers, with whom Garibaldi sailed from Genoa to their aid, overthrew the Bourbon government in Sicily. Garibaldi was proclaimed dictator in the name of Victor Emmanuel. In August Garibaldi crossed to Naples, defeated the royal army there, drove Francis II. to Gaeta, and entered the capital on the 7th September. Sardinia intervened and completed the revolution, when Garibaldi, handing over his conquests to the royal troops, retired to Caprera. A plebiscite confirmed the union with Piedmont, and Victor Emmanuel was proclaimed king of Italy, thus suddenly united almost in Mazzini's phrase, "from the Alps to the sea." Only the province of Venice and the Roman territory still remained outside. The former was won by Italy's alliance with Prussia in 1866 against Austria. The temporal power of the pope was still secured by French troops at Rome, till the French garrison was withdrawn at the outbreak of the Franco-German war in 1870, when Italian troops took possession of the city in name of King Victor Emmanuel. On 30th June, 1871, the seat of government was formally removed from Florence to Rome. In 1878 Victor Emmanuel died, and was succeeded by his son Humbert I. In 1900 Humbert was assassinated, and his son Victor Emmanuel III. ascended the throne.

The Italian language is one of the Romance tongues, or tongues derived from the Latin, and is therefore a sister of French, Spanish, and Portuguese. The oldest monuments of Italian literature go little further back than the beginning of the 13th century. The great luminary of this period, and by far the greatest poetic genius which Italy has produced, was Dante (1265–1321). (See Dante.) Francesco Petrarca (Petrarch; 1304–74), another of the great lights of Italian literature, exhibits in his sonnets and canzoni a vein less profound and transcendental than Dante's, but more humanly tender and passionate. Boccaccio (1313–75), a writer of great erudition and fertility, who produced classical translations, biographies, poems, etc., is Italy's first great storyteller. His great work is the Decamerone, a collection of a hundred tales.

During the 15th century the intellectual energy of Italy was almost entirely absorbed in the study of the ancient classics. This period is known as the renaissance, or the revival of arts and letters.

During the first half of the 16th century the renaissance movement perfected itself in every kind of art. In history the most noted names are Machiacelli, (1469–1527), and Francesco Guicviardini (1482–1540). Among the great poets of the period are Lodovico Ariosto (1474–1533), author of Orlando Furioso, a romantic epic, written in continuation of the Orlando Innamorato of Boiardo, and Torquato Tasso (1544–95), whose Gerusalemme Liberata is Italy's chief heroic poem. Among the lyrists of this century we may mention Michelangelo Buonarroti, and Vittoria Colonna, Benvenuto Cellini (1500–70) the famous artist in metal, whose autobiography is one of the most instructive lights on the spirit and manners of the age, and Giordano Bruno (1550–1600), a bold speculator and undaunted champion of liberty of thought. Of exceptional power was Alessandro Tassoni (1565–1635), who wrote the Secchia Rapita, a burlesque epic, and unquestionably the most important poetical production in Italian of the 17th century. The most eminent names of this period are those of scientific and philosophic writers.

About the middle of the 18th century a complete revolution took place in Italian literature, which was preceded and accompanied by a general elevation of public life. The influence of English and German literature began to communicate a more healthy tone to the national literature. Toward the end of the century the writings of the publicists Gaetano Filangieri and Cesare Beccaria indicate the growth of a social science

From the intellectual and political ferment which arose about the beginning of the 19th century Italy in particular recevied a much-needed stimulus. Alessandro Manzoni (1784–1883) has given Italy a few lyrics of the first rank, but the work which has most contributed to give him the high place he holds in literature is his novel, I Promessi Sposi. An equally high, if not a higher place, is due to the poetry of Leopardi. His prose is among the best that Italy has produced. The historico-political writings of Vincenzo Gioberti (1801–52) and Giuseppe Mazzini (1805-72) contributed powerfully to stimulate the national feeling and to shape the course of events. In history proper Amari (I Vespri Siciliani), Gino Capponi (Republica di Firenze), Ricotti, Zamboni, and others are the best known names. Among later and contemporary authors we may notice the poet, critic, and essayist Giosue Carducci; and Francesco de Sanctis (1818–86), the Sainte-Beuve and Matthew Arnold of Italy. Ruggero Bonghi, a biographer and essayist of superior rank and a frequent contributor to the periodicals; Edmondo de Amicis, Gabriel D'Aumerique and Mathilde Serao, novelists, are among the best known writers of the day.

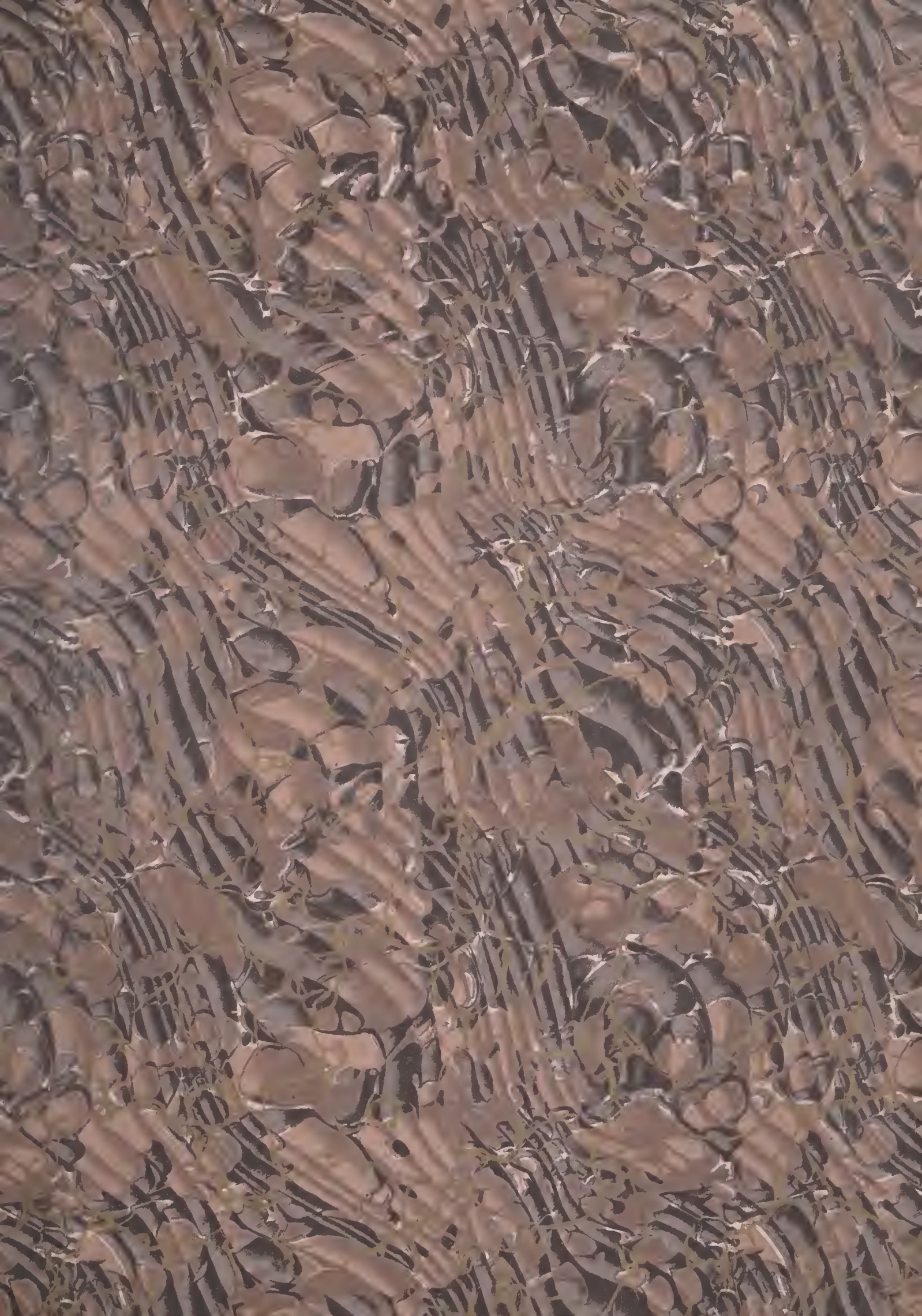
ITCH, a contagious cutaneous disease, appearing in small watery pustules on the skin, accompanied with uneasiness or irritation that inclines the patient to rub or scratch. It is occasioned by a small insect, which burrows within the epidermis; and is cured by sulphur, which should be applied externally in the form of ointment,.

ITCH-MITE, a microscopic insect of the class Arachnida, which produces itch in man. The female burrows in the skin, in which she deposits her eggs, which are hatched in about ten days, giving rise to this troublesome affection.

ITHACA, a city and county-seat of Tompkins co., N. Y., 60 miles southwest of Syracuse, at the head of Cayuga lake, and on the Lackawanna, the Lehigh Valley, and other railroads. Cornell university is situated on Cornell heights Population 20,000.

ITO (ē'to), Hirobumi, Marquis Japanese statesman, born in the province of Choshin in 1840. He eluded the vigilance of the Yedo spies and spent two years in England. He returned to Japan to dissuade the Choshin officers from war with the combined fleet of British, United States, French, and Dutch men-of-war at Shimonoseki. In 1871 he studied the coinage system of the United States and his report resulted in the adoption of a decimal system of money and the establishment of the mint at Osaka. As one of the Nice ambassadors he accompanied Iwakena round the world in 1872, in an effort to obtain from the powers some modification of the treaties. In 1886 the cabinet was reconstructed according to modern ideas. Ito became minister-president of state. For many years he superintended the reconstruction of law and the formation of codes no longer based on Chinese models, but in harmony with those in Christendom. He persuaded the court to adopt foreign dress. Ito introduced a new constitution more liberal in its provisions than some European governments allow. Called to the premiership again in 1892, he carried the nation through the Chino-Japanese war of 1894–95. He was again summoned by the emperor to the premiership, and under his direction Japan joined the allies in the rescue of the legations in Peking. He visited the United States on his way to Europe in 1901, received the degree of LL D. from Yale university,

I'VAN, or IWAN, the name of several rulers distinguished in Russian history. —Ivan III. (or I.), grand-prince of Moscow, was born 1440, ascended the throne



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